ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 2.] [1908.

VIII.—MUSEUM PREPARATIONS.

The Preservation of Green Colours in Botanical Specimens Exposed to Light.

J. W. H. Trail.

The alteration caused in green parts of plants after exposure to light for some time, whether these are dried or in preservative fluids, renders them unsightly, and deprives them of much of their value by obscuring or obliterating the distinction in colour between the assimilating tissues and the other parts of the specimen. With specimens in fluid, especially when preserved in alcohol, it is customary to bleach them until all parts are deprived of colour before they are admitted to the shelves of museums. Such bleached specimens are indeed preferable to the brown ones that are apt to result where alcohol is used without previous bleaching; and they have the further advantage, when bleached, of not discolouring the preservative fluid. But the uniformity of tint, whether brown or colourless, greatly lessens the usefulness of even the most carefully prepared specimens, especially in an educational museum, and I have sought by various methods to preserve the green colours at least sufficiently to indicate the important difference in function between the green parts and the other organs of plants. The various methods in use and the various solutions recommended as preservatives were tried, and, while partially successful in certain cases, all were unsatisfactory in results, or difficult to employ and liable to fail.

I had tried acetic acid as a preservative fluid; and found that although specimens, especially small bodies, such as galls, hermetically inclosed in glass tubes, retained their form in it they became discoloured. The effect of the salts of copper on the colour of vegetables preserved for food was known to me; but the value of copper as an aid in the preparation of permanent specimens for teaching, and for exhibition in museums, suggested itself to me more clearly after reading Dr. E. Schunck's papers on the chemistry of chlorophyll. I sought to obtain the formation within the green parts of the specimens of the compounds of

1375 Wt.87 2/08 D & S 29 31012

chlorophyll with copper that Dr. Schunck had shown to remain green when exposed to light. I at first made use of acetate of copper dissolved to saturation in strong acetic acid, one part of the solution being diluted with four of water. In this solution the specimens were allowed to steep for a month or more, they were then washed in clean water for a few minutes until clear of all trace of surface deposits of acetate of copper; and they were then transferred to any preservative fluid desired. A short account of the process is given in a report on methods employed by me for preservation of specimens submitted to a committee of the British Association, and printed in the Report of the meeting in Liverpool in 1896. As stated in that account, the method was found to give excellent results in certain cases, the green being quite permanent, and almost natural, except for a bluish tinge in it.

But in other cases the specimens became brown while being steeped in the solution of acetate of copper; and as the browning seemed worst in those plants, such as Oak, that contained much tannin, I supposed for a time that it was a compound of tannin formed with the copper that caused the discolouration. I continued to use the method, trying it with different groups of plants, and varying the details as to concentration. The more rapid and effective absorption of certain dyes and other substances by dead than by living protoplasm suggested the advantage of killing the protoplasm in the specimens as rapidly as possible. It was found that in the preservation of *Spirogyra* in conjugation, and of other algae that it was desirable to keep in stock for the use of students during the year, good results were obtained by boiling the material in a solution of acetate of copper before putting it into the preservative, whether formaldehyde or spirit. The compound of chlorophyll with the copper was formed very rapidly, in the hot solution, before any change due to decomposition had begun.

The extension of the method to larger specimens naturally followed, with very marked improvement in these as compared with the continued steeping in the cold solution. The hot solution penetrated more thoroughly and rapidly, and the green compound was formed in the tissues killed by the hot acid before decomposition had time to begin. Many plants were found to remain green when boiled in the solution of acetate of copper even of those that had always become brown when merely steeped in the cold solution. Another very great advantage of the use of heat is that it shortens very much the time required, the duration of treatment depending on the permeability of the tissues of each specimen. One or two minutes suffice for green seaweeds, and for submerged parts of vascular plants on which the cuticle is very thin, if present at all. The leaves and young stems of most plants require above five minutes' boiling. Those with thick cuticles and few stomata naturally require somewhat longer, up to 15 or 20 minutes in the more refractory specimens, the time to be allowed varying with the structure of the plants, and having to be estimated by experience.

After they have been boiled in the solution, and well washed in cold water to remove any surface deposits of acetate, they may be put at once into the preservative fluids, or they may be dried, if

suitable for that treatment. In either method they will usually show little change of colour when exposed to light. The green is often almost like that of the living plants; but in many it is more blue than natural, though retaining a decided green wherever chlorophyll was present in the living plant. In some cases where the specimens appeared brownish when removed from the boiling fluid the brown colour has been replaced by green in the spirit. Rarely does the colour become changed for the worse after permanent mounting.

When it is desired to preserve the green colour of dry specimens that are to be exposed to light they may be boiled in the solution of acetate, washed in pure water and dried, either by exposure to dry air, or in dry sand, or between sheets of botanical paper in the usual way, the method of drying being selected to avoid distortion in drying. Inflorescences of grasses give good results when simply exposed to dry air.

The colours of flowers and fruits are variously affected by this treatment. Some are destroyed by it, others, *e.g.*, the reds of rose-hips and various fruits, are largely retained. Occasionally curious results are obtained, as in the flowers of *Salvia splendens*, in which the colour disappeared from the corolla, but remained to a considerable extent in the calyx. The markings of variegated plants are well retained where these are pale on a green ground; and even where due to pigments or coloured sap these colours can often be recognised in the prepared specimens, even where much of their intensity has been lost.

An incidental advantage of the treatment is that the rapid killing of the tissues in the boiling solution lessens greatly the tendency to dismemberment by loss of leaves and even of branches, so troublesome in certain groups of plants, this result being more marked the shorter the time between the gathering of the specimens and the boiling. It is helpful in the treatment of such plants as *Sedum acre*, which are apt to remain alive for some time in the drying paper. It also helps to protect specimens against injury from fungi, so often hurtful in fluid preparations and in herbaria.

The experiments on the numerous plants selected by me for treatment were very carefully carried on by John Davidson, attendant in the Botanical Department of the University, and I take this occasion of expressing my appreciation of his services in this investigation.

Certain families of plants give less favourable results than one usually obtains, a dark exudation appearing on the leaves of some species. Probably further experiments will show means of overcoming some at least of these difficulties. Of course the treatment is not suitable for specimens so fragile that they would suffer injury from being boiled, even where the colour is well kept. But in many families the results are excellent, and in by far the most, even of the less favourable, the form is scarcely affected, the green parts remain clearly distinguished by their colour, and the educational value of the specimens is by so much the greater. It would be tedious to give a detailed statement of the effects of the treatment on the several plants subjected to it. The method is a

very simple one, and can be easily tried by anyone who wishes to test its worth. I believe it will be found useful. It is also economical in the saving of preservative fluids due to the lessened tendency to discolouration of these fluids by solution of substances (chlorophyll, &c.) from the specimens.

The method of treatment found to give the best specimens is as follows:—Saturate the volume (say one gallon) of commercial strong acetic acid with acetate of copper, shaking the bottle occasionally until no more will dissolve, some acetate being left at the bottom of the bottle. Pour off the clear solution, and add an equal volume of distilled or very soft water. Of this fluid enough is poured into an open enamelled or earthenware dish to allow the specimens for treatment to be submerged in it while it is being boiled over a suitable gas-burner. The specimens may be put at once into the boiling fluid, and should be kept sunk in it for periods as stated above, varying with their texture from two minutes to about twenty minutes. The fumes of boiling acetic acid are apt to be irritant to the eyes, nose, and throat, and also injure certain metals; hence it is well, if possible, to boil the specimens in a fume chamber, or in a place where the vapour can readily escape. The specimens should be lifted out with wooden forceps, and if they appear to have been boiled long enough they should be washed for a few minutes in water, and if necessary brushed or rubbed to remove deposits on their surfaces. They may then in most cases be prepared at once for permanent preservation, either in any of the usual preservative fluids, or dried.

IX.—DIAGNOSES AFRICANAE: XXI.

911. **Popowia Mannii**, *Baill. Adansonia*, vol. viii., p. 320 (1868) [Anonaceae]; descriptio emendata (auct. *T. A. Sprague*).

Frutex 1–1·5 m. altus (fide *Foster*). *Folia* obovato-oblonga usque ad elliptica, apice breviter obtuse acuminata, interdum leviter retusa, basi rotundata vel subcordata, 8–16 cm. longa, 3·5–6·5 cm. lata; petioli 2–5 mm. longi. *Petala* interiora in alabastro late ovata, demum subspathulata. *Ovarium* 1–3-ovulatum. Ceterum ut in descriptione Bailloniana.—*Clathrospermum Vogelii*, Oliv. in Fl. Trop. Afr., vol. i. (1868), p. 25, quoad specimen Mannianum. *C. Baillonii*, Scott Elliot in Journ. Linn. Soc., vol. xxx., p. 70 (1894). *Popowia Baillonii* Engl. et Diels in Engl. Monogr. Afr. Pfl., vol. vi., p. 48 (1901).

Sierra Leone. Bagru River, *Mann*, 809. S. Nigeria. Oloke Meji, *Foster*, 312.

Ovaries from Mann's specimen had two ovules, those from Foster's only one, but there appears to be no other difference between the specimens apart from the degree of pubescence.

Perhaps too much stress has been laid on the number of ovules in *Anonaceae*. Evidently Bentham found only one ovule per carpel on first examining Mann's specimen, but found 2–3 ovules on subsequent examination. In a manuscript note by Bentham attached to the sheet bearing Mann's specimen is the statement "Ovula solitaria erecta"; the last two words have been subsequently crossed out by Bentham and "2–3, superposita" substituted.

Engler and Diels in their monograph of the African Anonaceae, have changed the name of *Popowia Mannii*, Baill., to *P. Baillonii*, Engl. et Diels, and applied the name *P. Mannii*, Engl. et Diels, to another species, *Clathrospermum Mannii*, Oliv., apparently under the impression that *C. Mannii* was published before *P. Mannii*, Baill. *Adansonia*, vol. viii., p. 305, however, shows that Baillon's description was published on May 30th, 1868; Oliver's was published in July, 1868 (see *Kew Bull.*, 1905, p, 29).

It is therefore necessary to rename *P. Mannii*, Engl. et Diels (*Clathrospermum Mannii*, Oliv.), and inasmuch as it appears to be the only African species of *Popowia* with unisexual flowers, the name *Popowia diclina*, Sprague, seems appropriate. *P. diclina* is apparently dioecious, for the two sexes have not hitherto been collected together.

912. **Hibiscus crassinervius**, *Hochst. ex A. Rich. Tent. Fl. Abyss.*, vol. i., p. 61 [Malvaceae-Hibisceae]; descriptio amplificata (auct. *T. A. Sprague*).

Frutex ramis elongatis strictis 2–4 mm. diametro aspere fulvo-vel superne brunneo-tomentellis. *Stipulae* subulatae, ± curvatae, 3–5 mm. longae, tomentellae. *Folia* ovata vel elliptica, apice obtusa, basi rotundata, 1·3–4 cm. longa, 1–2·5 cm. lata, serrulata, aspera, basi 5-nervia, pilis stellatis supra dense pubescentia vel tomentella, subtus dense tomentella; petioli 3–10 mm. longi, dense tomentelli. *Flores* primum solitarii in axillis, denique ex iisdem axillis ramuli abbreviati 1–2-flori orti. *Pedunculi* 1–3 cm. longi, sub fructu 4–8 mm. infra apicem articulati. *Bracteolae* 9–12, lineares, versus apicem dilatatae, 3·5–8 mm. longae, superne 0·75–1·2 mm., inferne 0·5–0·6 mm. latae, basi 0·5–1 mm. connatae, trinerviae, breviter stellato-tomentellae praesertim extra. *Calyx* extra breviter stellato-tomentellus et pilis magnis brunneis stellatis hirsutus, intus minutissime appresse pubescens; tubus 2–2·5 mm. longus, 10-nervius reticulatione haud manifesta; lobi subulato-lanceolati, 3–7 mm. longi, ima basi 2–2·5 mm. lati, trinervii, nervo medio conspicuo, marginalibus inconspicuis. *Petala* oblongo-obovata vel obovata, 1·2–1·5 cm. longa, 6–7·5 mm. lata, basi 2·5–3 mm. adnata. *Stamina* 35, in verticillos quatuor disposita, quorum infimus pentandrus, circiter 0·5 mm. supra petala insertus, ceteri decandri filamentellis geminatis in verticillis mediis usque ad apicem, in supremo ultra medium connatis; filamentella circiter 4 mm. longa; columna staminea tota 7–8 mm. longa, 1·5–2 mm. ultra verticillum supremum producta, dentibus 0·25–0·3 mm. longis. *Ovarium* ellipsoideum, 2·75–3 mm. longum, dense appresse albo-pubescens, loculis 5-ovulatis; styli glabri pars communis 5–6 mm. longa, ramis 6·5–7 mm. longis. *Capsula* circiter 1 cm. longa, sparse appresse puberula. *Semina* circiter 2·5 mm. longa, conspicue punctata, villis circiter 5 mm. longis.—Mast. in Oliv. Fl. Trop. Afr., vol. i., p. 205; *H. gossypinus*, Mast. l.c. partim, non Thunb.

ERITREA. Keren, *Steudner* (no flowers on Kew specimen, hence determination uncertain). ABYSSINIA. Mt. Scholoda near Adowa, *Schimper*, Sect. ii., 646; Mt. Semejata, *Schimper*, Sect. ii., 936; Ouedjerate (Wojerat), *Quartin-Dillon & Petit*, 298; provinces of Tigre or Begemder, *Schimper*, 260 (ann. 1863–8);

Shoa (dedit *Franqueville* anno 1862); Ankober, *Roth*, 53; Alio Amba near Ankober, *Roth*, 150; Kambata, about 7° 30′ N., 38° E., nearly 1,800 m., *Wellby*; without precise locality, *Plowden*.

The single flower of Plowden's specimen examined had only 30 stamens, the lowermost whorl being absent.

One of the best characters of *H. crassinervius* is the shape of the bracteoles, which are distinctly broadened towards the apex. The bracteoles and calyx are much more densely clothed with stellate hairs than in *H. aponeurus*.

Hibiscus crassinervius, var. **minor**, *Sprague*; calycis lobis triangularibus staminibusque paucioribus a typo recedit.

Bracteolae 9–10, 3·5–5 mm. longae, superne parum dilatatae. *Calycis tubus* 2·5 mm. longus; lobi triangulares, acuminati, 2·5–3 mm. longi, basi 2–2·5 mm. lati. *Petala* 2 mm. adnata. *Stamina* 25, in verticillos tres disposita, quorum duo superiores decandri, infimus pentandrus. *Ovarii* loculi 5-ovulati.

ERITREA. Northern slope of Mt. Bizen, 1,700–1,800 m., *Schweinfurth & Riva*, 2053.

H. crassinervius var. *minor* has more the habit of *H. micranthus* than of *H. crassinervius*, but examination of the flowers leaves no doubt as to its true affinities. If the above-mentioned differences should prove to be constantly correlated, then var. *minor* would have to be raised to the rank of a subspecies.

913. **Hibiscus aponeurus**, *Sprague et Hutchinson* [Malvaceae-Hibisceae]; ab affini *H. crassinervio*, Hochst., bracteolis versus apicem haud dilatatis quam calyce manifeste brevioribus, calycis venatione et loborum forma recedit.

Frutex vel suffrutex, 0·3–1 m. altus, caule denudato ut ramis stricto dense aspere stellato-pubescente vel tomentello 2–4 mm. diametro. *Stipulae* subulatae, 3–6 mm. longae. *Folia* ovata vel elliptica (suprema interdum oblonga), apice rotundata vel obtusa, basi rotundata, 1·5–3·5 cm. longa, 1–3 cm. lata, serrulata, aspera, pilis stellatis supra pubescentia subtus tomentella vel pubescentia; petioli 2–10 mm. longi. *Flores* primum solitarii in axillis, denique ex iisdem axillis ramuli abbreviati circiter 2-flori orti. *Bracteolae* 9–10 (rarius 8), lineares vel lineari-subulatae, subacutae, 3·5–6·5 mm. longae, 0·4–0·75 mm. latae, basi vix connatae, extra pilis 2–4-radiatis, intus pilis simplicibus antrorse hirsutae. *Calyx* extra pilis 4–3-radiatis dense hirsutus, intus superne pilis antrorsis simplicibus vel biradiatis minute appresse pubescens inferne glaber; tubus 2–3 mm. longus; lobi lanceolati, subacuti, 4·5–9 mm. longi, basi 2–3·5 mm. lati, 3-nervii, et nervo medio et lateralibus conspicuis, vel sub-5-nervii, nervis submarginalibus inconspicuis additis. *Petala* oblongo-obovata, 1·6–1·7 cm. longa, 8–9 mm. lata, basi 3–4 mm. adnata. *Stamina* in forma typica 35, in verticillos quatuor disposita, quorum infimus pentandrus, 0·5–1·5 mm. supra petala insertus, ceteri decandri filamentellis geminatis; filamentella 1–2 mm. longa; columna tota 12–15 mm. longa, 1·5–2 mm. ultra verticillum supremum producta, dentibus 0·5 mm. longis. *Ovarium* 3·5–4·5 mm. longum, minute albo-tomentellum, loculis 5–7-ovulatis; styli glabri pars communis

6–10 mm. longa, ramis 3–9 mm. longis. *Capsula* 1–1·3 cm. longa, appresse puberula. *Semina* circiter 3·5 mm. longa, inconspicue punctata, villis circiter 5 mm. longis.—*H. crassinervius*, T. Thoms. in Speke, Journal of the Discovery of the Nile, p. 627 (App. G), non Hochst. *H. gossypinus*, Mast. in Oliv. Fl. Trop. Afr., vol. i., p. 205, *partim*, non Thunb. *H. gossypinus*, var., Oliv. in Trans. Linn. Soc., vol. xxix., p. 37, t. 14.

British East Africa. Near Nairobi, *Whyte*; between Kikuyu and the Eldama Ravine, *Whyte*; Ukamba, 1500–1800 m., *Scott Elliot*, 6497; Kiboss, *Linton*, 32; Kiu, *Linton*, 40; Makindu, *Linton*, 65; without precise locality, *C. F. Elliot*, 84, 137; Masai Country: Lykipia, 1800–2400 m., *Thomson*. Uganda. Koki District, *Dawe*, 350; Elgon District, *James*. German East Africa. Karagwe District, *Grant*, 215; Kilimanjaro, *C. S. Smith*.

Dawe, 350, has (in the single flower examined) five additional stamens, the three upper whorls being normal, and the lowest being replaced by eight solitary stamens and one pair arranged in two irregular whorls, thus bringing the total number of stamens to 40. *Linton*, 65, has practically the same staminal column. *Linton*, 32, has 45 stamens, in five whorls, of which the four upper consist of five pairs each, and the lowermost of five solitary stamens which alternate with the petals. In *Smith*, Kilimanjaro, on the other hand, the stamens are reduced in one flower to 30, and in another to 32, by the suppression respectively of all five and of three of the stamens of the lowermost whorl. All the other specimens quoted exhibit the typical arrangement of the staminal column.

Linton, 40, has abnormally large flowers: calyx-lobes 11–12 mm. long; petals nearly 2 cm. long, 11–12 mm. broad; staminal column 17 mm. long, the lowest whorl of stamens inserted 5 mm. above the petals; joint style 12 mm., branches 4 5 mm. long.

H. aponeurus is intermediate between *H. crassinervius* and *H. Hildebrandtii*, having the staminal column of the former, and bracteoles and calyx approaching those of the latter. In *H. crassinervius* the calyx lobes are three-nerved, and the lateral nerves of adjacent lobes unite just below the sinus and run down the calyx-tube as a single nerve, so that the tube is ten-nerved; in *H. aponeurus* the calyx lobes are likewise three-nerved, but often with an indication of two additional submarginal nerves, and the lateral nerves run down the calyx-tube parallel or approximating, only in rare instances uniting before reaching the base, so that the tube is fifteen-nerved.

914. **Hibiscus Wellbyi**, *Sprague* [Malvaceae-Hibisceae]; habitu *H. crassinervio*, Hochst. haud dissimilis, a quo tamen bracteolarum calycisque forma et indumento primo visu distinguitur.

Rami stricti, brunneo-stellato-pilosi, praesertim superne. *Folia* ovata, ut videtur subobtusa, 2·5–4.5 cm. longa, 2–3·5 cm. lata, basi rotundata, 5- vel sub-7-nervia, irregulariter serrata, pilis stellatis supra aspere pubescentia, subtus tomentella; petioli 0·5–1 cm. longi. *Pedunculi* 2·5–3 cm. longi, 5–8 mm. infra apices articulati, fructiferi 4 cm. longi. *Bracteolae* 10–11, lineari-subulatae, 5–7 mm. longae, 0·4–0·6 mm. latae, extra pilis magnis brunneis

biradiatis rarius triradiatis hirsutae, margine pilis simplicibus, intus inferne minute appresse pubescentes, superne pilis magnis brunneis simplicibus sparsissimis. *Calyx* extra pilis magnis brunneis 1–4-radiatis dense hirsutus, intus glaber lobis superne exceptis; tubus 3 mm. longus, 10-nervius, reticulatione manifesta; lobi e basi deltoidea subulati, 5–6·5 mm. longi, ima basi circiter 2 mm. lati. *Petala* anguste obovata, vix 2 cm. longa, 8–9 mm. lata, basi 3 mm. adnata. *Stamina* in verticillos quinque disposita, quorum quatuor superiores decandri filamentellis geminatis connatis; verticillus infimus e staminibus solitariis vel geminatis constans, paullo supra petala insertus; columna tota 1·2–1·3 cm. longa, 1·5 mm. supra verticillum supremum producta. *Ovarium* 3·5 mm. longum, loculis 6-ovulatis; styli pars communis 7 mm. longa, ramis 10–11 mm. longis, stigmatibus depresso-capitatis penicillatis circiter 0·5 mm. diametro.

ABYSSINIA. Between Harrar and Addi Abbaba, *Wellby*.

H. Wellbyi resembles *H. crassinervius* in the course of the main nerves of the calyx, but differs in the visible reticulation of the latter, and in having an additional whorl of stamens, as well as in the characters specified above.

915. **Hibiscus nyikensis**, *Sprague* [Malvaceae-Hibisceae]; affinis *H. Wellbyi*, Sprague, a quo foliorum et calycis loborum forma differt.

Innovationes et inflorescentiae dense brunneo-hirsutae. *Rami* adulti cinerei, basibus persistentibus pilorum punctulati, ramulis gracilibus. *Folia* oblonga vel oblongo-lanceolata, apice acuta vel obtusa, 1·5–5 cm. longa, 0·5–1·3 cm. lata, serrulata, basi obtusa vel rotundata, 5-nervia, utrinque aspere subtus densius pubescentia, venis media et lateralibus supra prominulis subtus prominentibus; petioli brunneo-hirsuti, 0·3–1 cm. longi. *Pedunculi* 0·7–2 cm. longi, 4–8 mm. infra apices articulati. *Bracteolae* 8–10, lineares, subobtusae, 3·5–6·5 mm. longae, 0·5–0·75 mm. latae, calycis lobos aequantes, extra pilis magnis brunneis 2–3-radiatis dense, intus sparse et marginibus pilis simplicibus hirsutae. *Calyx* extra pilis magnis brunneis 1–4-radiatis hirsutus, intus glaber apicibus loborum exceptis, manifeste reticulatus; tubus vix 2·5 mm. longus, irregulariter 15-nervius; lobi triangulares, 2·5–3·5 mm. longi, ima basi 2·5–2·75 mm. lati. *Petala* obovata, 1·7–1·8 cm. longa, 9–10 mm. lata, 2–2·5 mm. adnata. *Stamina* 50, in verticillos quinque decandros disposita, filamentellis geminatis connatis, infimis circ. 2 mm. longis, verticillo infimo circ. 2 mm. supra petala inserto; columna staminea 9 mm. longa, 1·5 mm. producta, dentibus lanceolatis 0·75 mm. longis. *Ovarium* 3 mm. longum, loculis 4–5-ovulatis; styli pars communis 4·5–6 mm. longa, ramis 4·5–5 mm. longis, stigmatibus vix 0·5 mm. diametro. *Capsula* (vix matura) circiter 1 cm. longa, appresse puberula.

NYASALAND. Nyika Plateau, 1800–2100 m., *Whyte*, 226; between Mpata and the commencement of the Tanganyika Plateau, 600–900 m., *Whyte*.

916. **Hibiscus Gossweileri**, *Sprague* [Malvaceae-Hibisceae]; habitu similis *H. micrantho*, Linn. f., sed potius affinis *H. crassinervio*, Hochst., a quo columna staminea et calycis laborum forma differt.

Caules satis graciles, pallide viridi-cinerei, pilis pluriradiatis majusculis brunneis subappressis conspicuis asperati. *Folia* ovata, apice acuta, basi obtuse cuneata vel subrotundata, 1·5–5 cm. longa, 1–2·5 cm. lata, serrata, utrinque aspera, supra puberula, subtus pubescentia, basi 5-nervia; petioli 0·5–1 cm. longi. *Pedunculi* circiter 1 cm. longi, paullo infra apices articulati, brunneo-hirsuti. *Bracteolae* 6–8, lineares, subacutae, superne haud vel vix dilatatae, 3–4·5 mm. longae, 0·5–1 mm. latae, extra dense, intus sparse antrorse hirsutae. *Calyx* extra pilis antrorsis dense hirsutus, magnis brunneis biradiatis praesertim in nervis sitis, minoribus pallidioribus numerosioribus interjectis; tubus 2–2·5 mm. longus, 10-nervius vel sub-15-nervius, intus glaber; lobi ovato-triangulares, obtusi, 3–3·5 mm. longi, basi 2–2·25 mm. lati, intus minutissime pubescentes. *Petala* obovata, circiter 1·5 cm. longa et 9 mm. lata, 2·5 mm. adnata. *Stamina* 30, in verticillos duo disposita, quorum superior icosandrus, staminibus per paria inserta, filamentellis usque ad basin liberis, inferior decandrus staminibus solitariis; filamentella 6–7 mm. longa; columna tota 6·5 mm. longa, supra verticillum superiorem 3 mm. producta; verticillus superior 1 mm. supra inferiorem, inferior vix ·5 mm. supra petala insertus. *Ovarium* 2·5 mm. longum, loculis 4-ovulatis; styli pars communis 6 mm. longa, ramis 5–7 mm. longis, stigmatibus circiter 0·5 mm. diametro. *Capsula* vix 1 cm. longa, minute puberula.

ANGOLA. District of Loanda, *Gossweiler*, 398.

One or two of the stamens of the lower whorl may be absent from their normal position and inserted along with adjoining stamens, so that we then have blank spaces and pairs instead of solitary stamens. The stamens of the lower whorl are normally opposite the pair of stamens of the upper whorl.

The nervation of the calyx varies slightly: the lateral nerves of adjacent lobes may either unite just below the sinus or may run down separately to the middle or to the base of the calyx-tube, so that the latter may have from ten to fifteen more or less distinct nerves.

917. **Balanites orbicularis**, *Sprague* [Simarubaceae]; foliis sessilibus, foliolis sessilibus orbicularibus apiculatis ab affini *B. aegyptiaca* distincta.

Rami leviter flexuosi, striolati, dense pubescentes. *Spinae* axillares, sed ad latus secundi foliorum superiorum allatae, ita ut extra-axillares videntur, 2–4 cm. longae, folia et flores gerentia. *Folia* sessilia, 1-juga, apice subulato circiter 2 mm. longo; foliola sessilia, orbicularia, 1·3–2 cm. diametro, acute apiculata, basi rotundata vel subcordata, utrinque pubescentia. *Cymae* in pseudofasciculos contractae, usque ad 5-florae. *Pedicelli* circiter 5 mm. longi. griseo-tomentelli. *Sepala* ovata, 4·5 mm. longa, 2·5–2·75 mm. lata, extra tomentella, intus sericeo-villosa. *Petala* oblonga obtusa, a medio versus basin angustata, 6–7 mm. longa, 2–2·5 mm. lata. *Filamenta* 3·5 mm. longa, antheris 1·5 mm. longis. *Discus* 2 mm. altus. *Ovarium* vix 1·5 mm. diametro, tomentosum, circiter 1 mm. in disco immersum.

BRITISH SOMALILAND. *Drake-Brockman*, 336, 337.

An interesting feature of *B. orbicularis* is that the branches are carried up the stem through two internodes above the leaf in whose axil they arise, so that they appear to arise at the side of the second leaf above.

918. **Malacantha obtusa**, *C. H. Wright* [Sapotaceae]; *M. alnifoliae*, Pierre, proxima, foliis basi truncatis recedit.

Rami juniores dense rufo-villosi, robusti, vetustiores glabri, lenticillati. *Folia* obovata, obtusa vel brevissime cuspidata, basi obtusa, 20 cm. longa, 12 cm. lata, utrinque primum pubescentia, supra demum fere glabrescentia; nervi utrinque circa 20, supra impressi, subtus prominentes; petiolus 8 mm. longus, crassus, dense villosus. *Flores* ad axin paniculae ramorum dense fasciculatim congesti. *Sepala* extus dense pubescentia, imbricata, elliptica, duo exteriora 5 mm. longa, 3·5 mm. lata, crassa, valide nervata, tria interiora paullo majora, tenuiora. *Corollae* tubus 4 mm. longus, 3 mm. diametro; lobi patentes, elliptici, obtusi, 3 mm. longi, 2·5 mm. lati, breviter ciliati. *Stamina* breviter exserta; filamenta ad corollae faucem affixa, subulata; antherae dorsifixae, 2 mm. longae. *Ovarium* ovoideum, dense hirsutum; stylus columnaris; stigmatis lobi 5, globosi. *Fructus* ellipticus, 2 cm. longus, 1·4 cm. diametro, 1-spermus. *Semen* ellipticum, lateraliter affixum, hilo albido excepto castaneum, exalbuminosum; cotyledones crassae, plano-convexae.

Western Tropical Africa. Lagos, *Foster*, 37.

919. **Faurea racemosa**, *Farmar* [Proteaceae]; affinis *F. forficuliflorae*, Baker, sed foliis a medio ad apicem sensim attenuatis, inflorescentia rufo-pubescente, floribus minoribus, squamis hypogynsi bifidis, villis ovarii multo longioribus et stylo sub apice haud torto multo breviore distincta.

Ramuli dense foliati. *Folia* lanceolata, a medio ad apicem acutum attenuata, basi acuta, 7–10 cm. longa, 2–3 cm. lata, glabra, coriacea, supra nitidula; petiolus 3–7 mm. longus, gracilis. *Racemi* densiflori, circa 11 cm. longi, 3 cm diametro; rachis ferrugineo-pubescens; pedicelli patuli, ferrugineo-pilosi, circa 4 mm. longi; bracteae minutae, deltoideae, apiculatae. *Perigonium* brunneum, glabrum, circa 13 mm. longum ad basin ad 2 mm. latum. *Antherae* 2·5 mm. longae; filamenta ad 2 mm. longa. *Squamae* hypogynae 1 mm. longae, triangulares, apice breviter acute, bifidae. *Stylus* 12 mm. longus, leviter recurvus, sub apice haud tortus; ovarii villi ad 7 mm. longi.

Africa. Mount Milanji, Nyassaland at about 2000 m., *G. Adamson*, 338.

920. **Panicum** (§ **Echinochloa**) **haplocladum** *Stapf* [Gramineae-Paniceae]; *P. cruri-pavonis* affinis sed paniculae ramis simplicibus, spiculis minoribus omnibus vel saltem interioribus breviter vel brevissime aristatis.

Gramen perenne, dense caespitosum. *Culmi* erecti, ultra 1·5 m. alti, inferne compressi, caeterum teretes, ad 5 mm. crassi, plerumque circiter 5-nodi, nodis superioribus breviter exsertis. *Folia* plerumque glaberrima, raro ad vaginas vel laminas hirsuta; vaginae basales compressae, carinatae, omnes laeves, leviter striatae; ligula nulla, saepe linea pilorum vel zona pubescente

substituta; laminae lineares, longissime attenuatae, basi brevissime vel vix rotundato-contractae, 30-50 cm. longae, 5-10 mm. latae, planae, saepe firmulae, ad margines asperae, caeterum plerumque laeves, costa tenui. *Panicula* erecta, lineari-oblonga vel elongato-pyramidalis, 10-16 cm. longa, 3-5 (raro basi ad 7) cm. lata, densa; axis subgracilis, profunde sulcato-striata, superne triquetra, ad angulos scabra, ad nodos pilis longis rigidis paucis vel interdum numerosis obsita; rami numerosi, quam internodia multi longiores, inferiores plerumque 2-3-natim approximati, 1-3 cm. longi, stricti vel interdum flexuosi, ab ima basi spiculigeri, axi gracili pubescente interdum setis hincinde additis; pedicelli brevissimi, geminati vel ternatim fasciculati. *Spiculae* secundae, 3-4-seriatae, congestae, ovoideae, caudato-acuminatae, serierum exteriorum interdum longius aristatae, 2-3 mm. longae, luride virides vel purpurascentes; *Gluma* inferior latissime ovata, minute apiculata vel mucronulata, 3-5-nervis, scaberula, superior late ovata, cuspidato-acuminata, longitudine spiculae, 5-nervis, inter nervos superne spinuloso-scabros magis minusve pubescens. *Anthoecium inferum* ♂; valva glumae superiori similis nisi dorso applanata, acumine saepe in aristam brevem tenuem ad 5 mm. longam (rarissime longiorem) abeunte; palea valvam aequans late oblonga, carinis superne subasperulis. *Anthoecium superum* ♂, ambitu ovatum vel ellipticum, apiculatum, fere longitudine spiculae, albidum, nitidum; valva crustacea, 5-nervis. *Antherae* 1 mm. longae.

British East Africa. Near Mombasa, in temporarily flooded localities, *Hildebrandt*, 1954–2022. Kikumbuliu Hills, *Scott Elliot*, 6291; Maji Chumoi, *Kässner*, 455; Baringo Marsh, *H. H. Johnston*. German East Africa. Turu, in boggy places, *Speke & Grant*. Rovuma River, *Meller*.

Speke and Grant observed a form having leaves marked with dark brown or black cross bars. Scott Elliot's and Johnston's specimens have practically no awns.

X.—JEQUIÉ MANICOBA AND ITS ALLIES.

(*Manihot dichotoma*, Ule and other species).

The first intimation to reach Kew of the existence of rubber-yielding plants closely related to the commonly cultivated *Manihot Glaziovii* took place in the early part of 1906. Mr. J. A. Davy, manager of the Dumont Coffee Company, Ribeirão Preto, São Paulo, Brazil, called at the Gardens in March and left some seeds of the Jequié or Jiquié Manihot. On his return to Brazil he sent us a supply of seeds together with the following information:—"at present we have two kinds of rubber trees growing here, the Manihot Glaziovii or Common Ceará Maniçoba, and the other Manihot Jequié, which is a native of the state of Bahia." In a subsequent letter (dated June 30th, 1906) Mr. Davy writes:—"as regards the Jequié variety of Manihots, this plant originates in the municipality of Jequié, State of Bahia, and is at present looked upon as a better latex producer than the Manihot

Glaziovii or Ceará. I am sending you the seed of this plant and eventually will forward some dried herbarium specimens. We have at present about 3,000 young sturdy Jequié plants growing. In appearance they are similar to the Ceará except that the ribs of the leaves have a red tinge while those of the Ceará are whitish. Again, in itself, the Jequié shows differences in the form of the foliage of the young plants, which you will understand when I forward the dried specimens."

Unfortunately no flowering specimens have as yet reached Kew from Mr. Davy, but that they are very necessary will be clear from the letter of our next correspondent on the subject.

In October, 1906, Mr. J. P. Rowe (since deceased) of Messrs. Anderson and Rowe, Bahia, wrote for information as to the tree which yielded Maniçoba rubber, and later presented a large consignment of seeds, which appeared to be identical with those sent by Mr. Davy. At the same time the following particulars were furnished by Mr. Rowe :—

"I have much pleasure in sending you particulars of the different varieties of Maniçoba rubber trees which are found in great numbers in the district of Jequié.

"According to my agent in that district, who has studied the subject there for three years, there are seven varieties which he has examined. In my opinion, however, there are more.

"Of the seven varieties my agent has selected for cultivation and is planting largely two which vary but very slightly, both being of most vigorous growth, developing very quickly flowering and seeding at an early age, with bark very smooth, soft, and easy to tap.

"Of one (A) called by the natives 'Maniçoba blanca' (white Maniçoba) the leaves (three-lobed) are pale green on the under surface with ribs of greenish-white, the contrast of the ribs with the leaf being sufficiently well marked to enable this variety to be identified at a glance by the natives, who have only to stand beneath the tree and look upwards through the foliage to distinguish the species with certainty. The latex is pure white, flows freely, and coagulates immediately without the use of any agent.

"The seeds you have sown at Kew ought to be all of this variety.

"Of the other (B) the ribs of the leaves on the under side are of a purplish colour, the leaf itself being of a darker hue than the 'white' Maniçoba. This variety is called by the natives 'Maniçoba rouxa' (purple). It is as vigorous in growth as the 'white' variety, and the latex is equally white and flows and coagulates as readily.

"A third variety (C) also grows vigorously in cultivation, being while still young very similar to those before mentioned, but as it increases in age the bark, which is silvery, hardens, roughens, and peels off in flakes like that of the birch. The latex is white and coagulates readily.

"Two other varieties (D and E) have also rough barks, but marked with small brownish patches. These have not been cultivated by us, as the bark is harder to cut, and the flow of latex is scanty.

"In addition to the foregoing species there are two others, both inferior, for the reasons that the latex, which is pale green in colour, is scanty, and when coagulated the rubber contains a high percentage of resin.

"Of the 'A' and 'B' varieties we have cultivated trees the trunks of which at 14 months old were 4 inches in diameter at 3 feet from the ground, and 10 feet high. Some of these young trees were flowering and seeding at that age.

"Our plantations are mostly formed of young seedlings taken from the forests, which contain vast numbers. They are transplanted 1,000 to the acre, and do not appear to be too crowded. The transplantation causes no apparent set-back, and the close planting has a good effect in keeping down the scrub undergrowth. At three years old cultivated trees of the two first-mentioned varieties have yielded 7 ounces of dry rubber on the average."

A further supply of "Maniçoba seeds" was received from Mr. H. Stevenson, H.B.M.'s Acting Consul at Bahia, and reached Kew in March, 1907.

These seeds, as well as plants raised from the seeds sent by Mr. Rowe, have been distributed to the botanical stations and gardens of India and the Colonies.

The following table shows the distribution of the plants raised at Kew, and sent out in Wardian cases on May 23rd, 1907:—

No. of Plants.	Destination.	Condition on Arrival.
200	Calcutta ... —	"Good."
100	Ceylon	"Excellent."
100	Singapore	"Good."
100	Java	No information.
50	Fiji	
50	Brisbane...	
50	Penang	"Excellent, all living."
50	Kuala Lumpur...	No comments.
50	Bangalore	
50	Hongkong	"Splendid."

Two plants were also sent to British Central Africa, and one plant to N.W. Rhodesia with other plants. In addition to the plants, seeds, received from Mr. Stevenson, were sent to Calcutta, Ceylon, Kuala Lumpur, Singapore, and Brisbane.

In consequence of this last consignment of seeds a correspondence was opened with Mr. O'Sullivan Beare, H.B.M.'s Consul at Bahia, on the subject. He has supplied much information which is incorporated in the Diplomatic and Consular Report on the trade of Bahia for the years 1904-1906 issued in August, 1907. The following extract is taken from this report:—

"The export of rubber from the State of Bahia has increased more than tenfold within the past six years, having risen from 100 tons in 1900 to over 1,100 tons in 1906.

"Of the total quantity of rubber exported annually from Bahia, the greater proportion has hitherto been of low grade, consisting mainly of a variety known as 'Mangabeira' rubber, which comes

from the adjoining States of Minas Geraes and Piauhy. But it has lately been discovered that the State of Bahia is very rich in a rubber-producing tree, locally known as 'Jiquié Maniçoba.' The tree in question is a new and distinct species of Manihot, which apparently is peculiar to the State of Bahia.

"The discovery is a matter of much importance not only for this State but also for the rubber trade in general, inasmuch as the rubber obtainable from the Jiquié Maniçoba, when properly prepared, would seem to be equal in quality to the best product of the Pará region.

"This matter of Jiquié rubber appears to be of so much interest, and there exists so much misunderstanding with respect to it, that I may be excused for giving here some particulars concerning the tree from which the rubber in question is derived.

"The Maniçoba of Bahia is a tree which attains to a height of 30 feet and upwards, with a diameter of some 2 feet, when fully matured in suitable soil.

"It belongs to the family of *Euphorbiaceae* as does also the *Hevea brasiliensis* which produces Pará rubber, yet it is closely akin to Manihot, aipins or macacheiras, mamomeiras, Seringueiras, &c. Its zone, so far as is at present known, extends from Maranhão to the southern borders of the State of Bahia. It flourishes throughout the 'Sertão'* within the limits specified, but is found in greatest abundance in the regions adjoining the town of Jiquié, whence its local name.

"The Jiquié Maniçoba is undoubtedly a new and distinct species of Manihot, and it must not be confounded with the Manihot of Ceará (*Manihot Glaziovii*, Muell. Arg.). The seeds of Jiquié Maniçoba are much larger than those of the Maniçoba of Ceará.

"The season for extracting the latex from the Jiquié Maniçoba extends from August to March. The latex possesses the valuable property of coagulating spontaneously when exposed to the air, and it requires no acid or other artificial coagulant of any kind.

"It has been found, from experiment, that the Jiquié Maniçoba tree can be made to yield its latex between the fourth and fifth years from time of first planting; but the tree yields its maximum returns from the age of eight years onwards.

"The planters of Bahia have awakened to the fact that in the cultivation of Jiquié Maniçoba they possess a source of much potential wealth. Already several fazendeiros have begun to lay down plantations of the tree in question upon a large scale. The two most extensive of those plantations are situated one upon the Island of Joannes, close to the city of San Salvador, the other in the district of Machado Portella. The Agricultural Institute, which has recently been established by the State, proposes to devote special attention to the systematic cultivation of Jiquié Maniçoba, and to the preparation of rubber derivable therefrom.

"A planter established in the Jiquié district recently prepared a considerable quantity of rubber obtained from Maniçoba trees

* "Sertão," a term applied to vast spaces in the interior of Brazil, covered with brushwood and diversified by great tracts of forest.

growing wild in that neighbourhood, and despatched it to New York. The consignment was classified in the New York market as being equal to the best Pará rubber, and it fetched 1 dol. 20 c. (5*s.*) per lb."

In answer to a further request for botanical specimens of the Jequié Maniçoba the following letter was received at Kew :—

H.M.'s Consul, Bahia, to Royal Botanic Gardens, Kew.

H.B.M.'s Consulate, Bahia,
4th September, 1907.

Dear Sir,

With reference to your letter of 11th July last requesting further information respecting Maniçoba, I have just learned that a German botanist, Professor Ule, who recently visited the States of Bahia and Piauhy for the purpose of collecting specimens of the rubber-producing plants which grow in those two States, has decided, after having conferred with his colleagues at Berlin respecting the matter in question, that the three species of Maniçoba which grow in the States of Bahia and Piauhy all differ essentially from *Manihot Glaziovii*, of Ceará.

The German botanists have decided to distinguish the three species of Maniçoba found growing in the States of Bahia and Piauhy by the following designations, viz. :—

So-called Jiquié Maniçoba = *Manihot dichotoma ;*

„ S. Francisco Maniçoba = *Manihot heptaphylla ;*

„ Piauhy Maniçoba = *Manihot piauhyensis.*

As regards the name "Maniçoba," it would appear to be a generic term applied, locally, to all species of Manihot which yield rubber.

I am, &c.,

(Signed) D. R. O'Sullivan-Beare,
H.B.M.'s Consul.

On the 20th of September Mr. O'Sullivan-Beare wrote again, promising herbarium material, and sending two samples of rubber, namely, a sample of so-called Jiquié rubber (obtained from *Manihot dichotoma*), and a sample of so-called Rio Sâo Francisco rubber (obtained from *Manihot heptaphylla*). These are now in Museum No. 1, and are both rubbers of good quality.

The young plants raised from the seeds sent by Messrs. Davy, Rowe, and Stevenson appear to be all similar. The seeds germinated very readily, and the plants, now some nine months old, are characterised by the somewhat thickened lower portion of the stem. In the shedding of the bark these plants differ from *Manihot Glaziovii*, since longitudinal slits are formed, and the membranous bark peels off in more or less vertical rows ; the leaves of the young plants appear to have had greenish-white veins in all cases, thus differing from Davy's plants grown in Brazil, but this may be due to the artificial conditions of cultivation.

Other attempts to obtain material which would have enabled the question of these Maniçobas to have been solved at Kew have proved in vain, and the following extract from a letter from

Senor J. Limâo da Costa helps to show the difficulties besetting the subject :—

" The Maniçoba of Jequié is a variety of that plant existing in Ceará and in this State, in the San Francisco region. Absolutely different to that is the species named Jequié (locality where it abounds in a wild state), as it presents various specimens [? considerable variation] in the trees from which latex is extracted. The trees commonly known as Jequié Maniçoba abound mostly in the municipalities of Maracá, Pocoes, Conquista, &c."

In Mr. O'Sullivan-Beare's letter to Kew of September 4th, 1907, already quoted, reference is made to Professor Ule's visit to the States of Bahia and Piauhy for the purpose of investigating the sources of Maniçoba. His results have recently been published in *Notizblatt des Königl. botanischen Gartens und Museums zu Berlin, Dahlem*, No. 41 (Bd. V.), of November 27th, 1907, where diagnoses of the three new species of *Manihot* are given, and a further and more detailed account of these newly discovered sources of rubber has appeared in *Der Tropenpflanzer* No. 12, for December, 1907.

From the Consular Report on the trade of Bahia, quoted above, it seems probable that these species are likely to be of considerable importance, and the following account has therefore been compiled from the information contained in these papers. Dr. Ule undertook two journeys into the States of Bahia and Piauhy under the auspices of the Bahia Rubber Syndicate of Leipsic in the year 1906. In the interior two distinct and nearly related rubber yielding species of Maniçoba were found, the one growing on the mountains of the right bank of the Rio San Francisco, and the other, confined to the country at some distance from the left bank, occurring especially in the adjoining State of Piauhy. The latter appears to be the better species. One species was discovered in the wooded steppes of the Serra do San Ignazio growing in places where the Mangabeira (*Hancornia speciosa*) also flourishes. This Maniçoba, however, grows rather on the rocky country (Felsenformation), and is thus a true mountain plant.

The three species of Manihot are described under the names *M. dichotoma*, *M. heptaphylla*, and *M. piauhyensis*, and the following diagnoses are taken from Dr. Ule's paper :—

Manihot dichotoma, Ule.

Petioli limbum aequantes, limbus 3–5 partitus, membranaceus ; laciniae obovatae, integrae vel ± late sinuatae, glabrae ; racemi subpauciflori ; bracteae margine denticulatae, quam flores breviores, caducae ; flores intus extusque glabri ; capsulae ellipsoideae, breviter alato-6-costae ; semina ellipsoidea.

M. heptaphylla, Ule.

Petioli limbum fere aequantes, limbus profunde 7-, raro 5-partitus ; laciniae oblanceolatae, leviter vel altius lyrato-constrictae, coriaceo-membranaceae ; racemi densiflori, macranthi ; bracteae flores superantes, integrae ; flores extus intusque glabri ; capsulae subglobosae, exalatae, leviter 6-angulosae acutae.

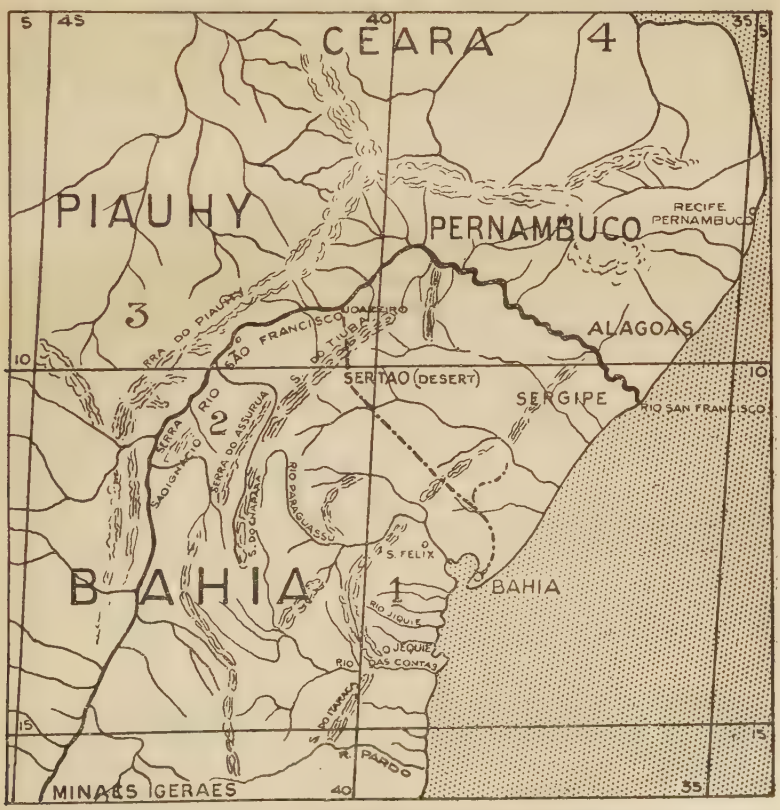
M. piauhyensis, Ule.

Petioli limbum fere aequantes, limbus profunde 5-partitus ; laciniae late obovatae vel oblongo-obovatae, apice rotundatae,

coriaceo-membranaceae ; racemi elongati, macranthi ; bracteae flores superantes, integrae ; flores extus intusque glabri ; capsulae subglobosae, acutiusculae, manifeste subalato-costatae.

Manihot dichotoma does not form quite so large a tree as Ceará *M. Glaziovii*, and is from 5–12 metres (16–39 feet) in height, at the same time the growth of the crown is much more compact and for the most part densely dichotomously branched. The stem also does not become so thick and the bark is thinner and usually paler, though a variety with a darker bark is known. The leaves of *M. dichotoma* are 3–5-partite—it is only in the seedlings that they are somewhat peltate—they are also much smaller than those of *M. Glaziovii*. The smaller leaves and the large, long seeds afford the most important characters for distinguishing this species from *M. Glaziovii*.

M. dichotoma is confined to the south-east of the State of Bahia from 12·5°–14·5° S. lat., where it extends from the region of the middle Rio Paraguassu to the middle course of the Rio das Contas. It derives its name of Jequié Maniçoba from the small town of Jequie in that locality, which serves as the centre of the rubber trade as regards this plant.



Sketch map of a portion of N.E. Brazil to show the distribution of the newly discovered Maniçobas.

1. Region of *M. dichotoma*.
2. Region of *M. heptaphylla*.
3. Region of *M. piauhyensis*.
4. Region of *M. Glaziovii*.

—·— Railway from Bahia to Joazeiro on the Rio São Francisco.

It grows in the true "catinga,"* being found especially on the mountain slopes, which might be called "mountain catinga." It avoids the more park-like situations, where isolated and somewhat larger trees are more prominent and prefers a rather denser woody "catinga." The tree thrives best on red, loamy soil, and is found more rarely on sandy soil. Some miles from Porto Alegre, on the Rio das Contas, the mountain slopes have been seen by Ule so well covered by these trees that they constituted nearly 50 per cent. of the forest.

It seems probable, however, that the wild supply will soon be exhausted.

Manihot heptaphylla and **M. piauhyensis**, whose rubber is exported principally along the Rio San Francisco, are quite different in habit from *M. dichotoma*. They both form low trees with short stems, and their broad and densely leafy crowns are forked two or three times.

M. heptaphylla is 3–8 metres (9–26 feet) in height with blackish-brown bark and beautiful purple twigs; the leaf lamina is usually 7-partite and dark green; the seeds are roundish as in *M. Glaziovii* but larger and paler than in that species.

It occurs exclusively on the right bank of the Rio San Francisco, from 9·5°–12·5° S. lat., especially in the mountainous districts of the Serra do Encaibro, Serra do Tombador, Serra do Assuruá, etc.

It has been observed in the wild state only in a restricted area near the village of Chique-chique in the Serra do San Ignazio, where it grows with other trees amongst the sandstone rocks. Sometimes it is found in company with Mangabeira.

M. piauhyensis is closely allied to *M. heptaphylla*, but forms somewhat smaller trees from 2–5 metres (6–16 feet) in height; it differs in having 5-partite leaves with broader tips. The racemes also are longer and the fruits are winged at the corners. The seeds can scarcely be distinguished from those of *M. piauhyensis*.

The locality for this species extends from the region to the south-east of the State of Piauhy along the boundary of Bahia from about 8°–10° S. lat. It grows in the rather lower sandstone mountain ranges, which stretch southwards from Ceará. In this region the trees of *M. piauhyensis* cover a wide area and are distinguished by their fresh vivid green from the low trees with which they are intermingled.

Isolated examples may be seen among the rocks, and the trees appear to succeed best on a sandy soil. This species often shoots up in abundance in places where the forest has been recently destroyed by fire.

Collection of Rubber.—The mode of collection of the rubber from these three species differs from that in use for *M. Glaziovii*, owing to the differences in the habit of growth and the nature of the barks of these trees.

* Catinga is a term used to denote small woods, consisting of trees of small and medium size, in the Brazilian Savanahs.

In *Manihot dichotoma* the stem is cut in a wavy line by means of a knife, which is curved or rounded at the apex, and a small metal cup is placed at the end of the cut to collect the latex. The latex begins to coagulate as soon as collected, and it is then pressed by hand into balls, which are afterwards usually compressed in cylinders and then well dried. With careful methods a tree may be tapped from three to ten times. The rubber obtained annually at the present time from the wild growth of *M. dichotoma* may be reckoned at 400 to 500 tonnes.* In this calculation plantations do not yet come into consideration, since the discovery of this tree was only made in 1901 and the trees first planted are only just becoming ready for tapping.

The method of obtaining the rubber from the two other species is nearly identical, but differs from that described for *M. dichotoma* owing to their short stems and the somewhat harder nature of the bark. A cut just above the root has proved to be most effective, and for this purpose a small hole is dug on one side of the stem and lined with clay ; scratches are then made just above the neck of the root and the latex flows into the little pit where it coagulates and is collected one or two days later.

A cake of from 10–100 grammes may be obtained from a single tapping.

M. heptaphylla yields about 500 tonnes of rubber per year, whilst for *M. piauhyensis* the output of rubber is estimated at at least 600 tonnes in the year.

Plantations.—At present the plantations of *M. dichotoma* are rather young and only the oldest are ready for tapping ; but from the two other species, which have been known longer, a satisfactory amount of rubber is now being brought on to the market. In the plantations, which are laid out in a quite primitive manner, the seeds are planted in rows two metres apart, making 2,500 trees to the hectare (2·47 acres). Other plants may be grown between the rows during the first year. With regard to tapping, *M. piauhyensis* is ready in the third year and the other two species may be tapped in their fourth year of growth. The yield of rubber from a single tree of *M. dichotoma* in one year can be reckoned at from 100–200 grammes with present methods, and this is equivalent to 200–300 kilogs. per hectare.

The annual yield of rubber for single trees of *M. piauhyensis* and *M. heptaphylla* is from 500–1000 grammes, which corresponds roughly to about 1 tonne per hectare.

Value of the Rubber.—The market value of the three kinds of rubber, according to the rate of October 28th last, was for

M. heptaphylla	...	6*s.*–6*s.* 6*d.* per kilo.
M. piauhyensis	...	7*s.* 6*d.* per kilo.
M. dichotoma	...	8*s.*–8*s.* 6d. per kilo.

Para rubber being quoted at 9*s.* per kilo.

The cultivation of Ceara rubber (*M. Glaziovii*), which has been pursued with more or less profit in many cases, has had to be

* 1 tonne (1,000 kilog.) = ·934 of a ton.

given up in some places owing to its failure to pay, due partly to the injury caused by wind and by careless tapping, and also to the hardness of its bark.

The advantage of the three species from Bahia and Piauhy is that they are less liable to the injuries just mentioned and that, speaking generally, the yield of rubber is far higher than in *M. Glaziovii*. One hectare planted with *M. Glaziovii* is estimated to yield 300 kilos, whilst 1000 kilos per hectare is the amount reckoned for *M. piauhyensis* or *M. heptaphylla* when planted in suitable positions. Such a yield exceeds even that of *Hevea brasiliensis*.

As to the relative values of *M. piauhyensis* and *M. heptaphylla*, the former yields a slightly more valuable rubber, and the tree is ready for tapping somewhat earlier. On the other hand, the latter appears to be a longer-lived tree.

Comparing the Maniçoba plants with *Hevea*, Ule remarks that there is no doubt that the rubber of *H. brasiliensis* is of better quality, possesses greater elasticity and obtains the higher price, but in spite of this the characteristics of these Manihots make them well worthy of cultivation.

Conclusions.—One of the conclusions drawn by Ule, from the facts set out, is that wherever conditions are suitable the cultivation of *M. Glaziovii* will have to be replaced by that of the Maniçobas from Bahia. The question as to which of the three species is to be preferred depends chiefly on the nature of the soil, since they grow under nearly similar climatic conditions.

In a rather firm, loamy soil *M. dichotoma* is the most suitable species, whilst *M. heptaphylla* and *M. piauhyensis* should be planted in a light sandy soil. *M. dichotoma* has the advantage over the other two species in that its seeds germinate especially easily.

Hevea brasiliensis is obviously the most important plant for luxuriant tropical regions, whilst *M. heptaphylla* and *M. piauhyensis* must be regarded as the rubber plants of the future for dry and less fertile districts.

Dr. Ule promises further details, together with a map and five plates in the next number of "*Notizblatt*."* The rough outline map included in this article is added for the convenience of the reader.

XI.—NEW ORCHIDS: DECADE 31.

301. **Liparis tabularis**, *Rolfe* ; species insignis, a *L. macrantha*, Rolfe, labello orbiculari obtuso et venis regulariter flabellatis differt.

---

* Dr. Ule's full paper in *Notizblatt*, No. 41A, Bd. V., of January 25th, 1908, has come to hand while this article is in the press. A map and photographs of the three Manihots are given, as well as drawings of the leaves, flowers, fruits, and seeds.

Pseudobulbi anguste conici, 8–10 cm. longi, circa 2 cm. lati, vaginis membranaceis albidis venosis imbricatis tecti. *Folia* membranacea, ovato-elliptica, breviter acuminata, undulata, plicata, 10–12 cm. longa, 4–5 cm. lata ; petioli dilatati, in vaginis imbricatis spathaceo-oblongis acutis carinatis et striatis inclusi. *Scapus* erectus, acute 5-angulatus, purpureus, circa 15 cm. altus ; racemus laxus. *Bracteae* triangulari-subulatae, acutae, 2 mm. longae. *Pedicelli* angulati, purpurei, 1·5 cm. longi. *Flores* magni, purpurei. *Sepalum* posticum oblongo - lanceolatum, acutum, 1·5 cm. longum ; sepala lateralia oblonga, acuta, circa 1·2 cm. longa, marginibus revolutis. *Petala* filiformia, 1·5 cm. longa. *Labellum* orbiculare, crebre denticulatum, leviter recurvum, 1·5–1·7 cm. latum, ima basi callosum. *Columna* clavata, incurva, 8 mm. longa.

PENANG. *Curtis.*

Sent to Mr. H. A. Tracy, of Twickenham, by Mr. C. Curtis, of the Forest Department, Penang, and flowered in the collection of Mr. H. T. Pitt, Rosslyn, Stamford Hill, in April, 1906. It flowered at Kew in June of the following year, when a drawing was made for the *Botanical Magazine.*

302. **Liparis Warpuri**, *Rolfe* ; a *L. parva*, Ridl., floribus majusculis, labello crenulato differt.

Herba caespitosa, pusilla. *Caules* approximati, carnosuli, 2–3 cm. longi, monophylli, vaginis imbricatis puncticulatis obtecti. *Folia* sessilia, anguste ovata, acuta, subconduplicata, supra glaucescentia, 3–4·5 cm. longa, circa 1 cm. lata. *Scapi* graciles, 4–6 cm. longi, apice 2–1-flori. *Bracteae* sessiles, cordatae, acuminatae, 7–8 mm. longae, 3–4 mm. latae. *Pedicelli* 1–1·3 cm. longi. *Flores* majusculi, virides. *Sepalum* posticum lineare, circa 1·8 cm. longum, marginibus revolutis ; sepala lateralia falcato-oblonga, obtusa, 1·5 cm. longa. *Petala* deflexa, filiformia, circa 1·4 cm. longa. *Labellum* recurvum, breviter unguiculatum, obovatum, denticulatum, circa 1·2 cm. longum, 1 cm. latum ; discus carnosus, minute verrucosus, ad basin callo bicornuto parvo instructus. *Columna* incurva, 6–7 mm. longa, alis parvis obtusis.

MADAGASCAR. *Warpur.*

A curious little plant, introduced about seven years ago, which has flowered several times in the Kew collection, and never exceeds a few inches high. The flowers are few and large for the size of the plant, light green, with a dark green disc to the lip.

303. **Cirrhopetalum fascinator**, *Rolfe* ; a *C. appendiculato*, Rolfe, floribus multo majoribus, segmentorum appendicibus linearibus nec foliaceis differt.

Herba epiphytica. *Rhizoma* repens, validum. *Pseudobulbi* breviter tetragono-oblongi, nitidi, 1·5–2·5 cm. longi, 1–2 cm. lati, monophylli. *Folia* sessilia, coriacea, elliptico-oblonga, obtusa, 2–7 cm. longa, 1·5–3 cm. lata. *Scapi* patentes, circa 10 cm. longi, uniflori. *Bracteae* spathaceae, apice acutae, 1 cm. longae. *Flores* magni, pallide virides, purpureo-punctati et ornati. *Sepalum* posticum ovatum, acuminatum, 2·5–3 cm. longum, supra medium

ciliatum et appendicibus filiformibus amethystino-purpureis ornatum ; sepala lateralia connata, oblongo-lanceolata, longissime caudato-acuminata, 13–18 cm. longa, basi coriacea, crebre verrucosa, marginibus revolutis. *Petala* falcato-oblonga, subacuta, circa 2 cm. longa, margine et apice appendicibus filiformibus amethystino-purpureis ornata. *Labellum* recurvum, ovato-oblongum, subobtusum, canaliculatum, bicarinatum, carinis et marginibus puberulis. *Columna* lata, 8 mm. longa, marginibus acutis, alis latis tridentatis.

ANNAM. Attopen, *Micholitz.*

Introduced by Messrs. Sander & Sons, from whom it was received in 1905, and flowered at Kew in September, 1907. The ground colour of the flowers is light green, and the markings dull purple, these consisting of five stripes and a few spots on the dorsal sepal, and numerous minute dots on the column and on the base of the petals, while the lip and sides of the lateral sepals are suffused with the same colour. The remarkable appendages on the petals and dorsal sepal are amethyst-purple in colour.

304. **Cirrhopetalum papillosum,** *Rolfe* ; a *C. retusiusculo*, Reichb. f., et omnibus speciebus generis mihi notis, sepalis lateralibus papilloso-hispidis facile distinguendum.

Rhizoma breve. *Pseudobulbi* approximati, anguste elliptico-oblongi, 2 cm. longi, circa 8 mm. lati, monophylli. *Folia* anguste oblonga, subobtusa, coriacea, circa 4 cm. longa, 7–8 mm. lata. *Scapi* graciles, circa 5 cm. longi, vaginis lanceolatis paucis obtecti. *Bracteae* lanceolatae, acuminatae, 6–7 mm. longae. *Flores* umbellati, circa 6, mediocres. *Pedicelli* 6–7 mm. longi. *Sepalum* posticum ovato-oblongum, subobtusum, eciliatum, 3–4 mm. longum, trinerve, venis sparce papillosis ; sepala lateralia lanceolato-linearia, acuminata, plus minusve connata, 2–2·5 cm. longa, infra medium copiose papilloso-hispida. *Petala* lata elliptico-oblonga, obtusa, eciliata, 3–4 mm. longa, trinervia. *Labellum* recurvum, oblongum, obtusum, canaliculatum, glabrum, 2 mm. longum. *Columna* lata, 1·5 mm. longa, dentibus brevibus subacutis.

SIAM. Mountains round Chiengmai, on deciduous trees at 600 m. alt., *Dr. Arthur Kerr.*

Flowered at the Trinity College Botanic Garden, Dublin, in July, 1907, and sent to Kew for determination by Prof. Henry H. Dixon. The dorsal sepal and petals are lined with dark purple on a pale ground, and the lateral sepals marbled and speckled with red-brown. The remarkable papillose-hispid lateral sepals show a character not previously observed in the genus.

305. **Coelogyne virescens,** *Rolfe* ; a *C. Parishii*, Hook. f., labello angustius, disco tricarinato carinis crenulatis non crebre papillosis differt.

Psendobulbi oblongi, crassi, subtetragoni, leviter sulcati, circa 11 cm. longi, 2·5 cm. lati, apice diphylli. *Folia* lanceolato-oblonga, acuminata, undulata, circa 18 cm. longa, 4 cm. lata. *Racemi* terminales, circa 15 cm. longi, 5-flori, basi vaginis lanceolatis

obtecti. *Bracteae* lanceolatae, acuminatae, concavae ; carinatae, 2–3 cm. longae, persistentes. *Pedicelli* 1·5–2 cm. longi. *Flores* mediocres, pallide viridi, labello atro-punctati. *Sepala* patentia, late lanceolata, acuminata, carinata, 3 cm. longa, 1 cm. lata. *Petala* lineari-lanceolata, acuminata, apice leviter recurva. *Labellum* 2 cm. longum, trilobum, leviter recurvum ; lobi laterales oblongi, obtusi, 1 cm. longi ; lobus intermedius ovatus, apiculatus, valde undulatus ; discus tricarinatus, carinis crenulatis, lateralibus elevatis, media nana et prope basin duplicata. *Columna* clavata, subalata, 1·5 cm. longa.

ANNAM. In the cataract district, *Micholitz*.

Introduced by Messrs. Sander & Sons, and flowered in their nursery at St. Albans in April, 1907. With a general resemblance to *C. Parishii*, Hook. f. (*Bot. Mag.* t. 5323), the flowers are wholly different in the details of the crest.

306. **Geodorum pacificum**, *Rolfe* ; a *G. semicristatum*, Lindl., segmentis angustioribus, labelli lamellis non cristatus differt.

Rhizoma validum. *Caules* approximati, breves, 2–3-phylli, basi vaginis lanceolatis subimbricatis obtecti. *Folia* lanceolata vel oblongo-lanceolata, acuminata, plicata, submembranacea, basi attenuata, 15–30 cm. longa, 2·5–5·5 cm. lata. *Scapi* erecti, 30–45 cm. longi, vaginis lanceolatis obtecti, apice nutantes ; racemi 2–5 cm. longi, multiflori. *Bracteae* lineari-lanceolatae, acuminatae, membranaceae, 5–14 cm. longae. *Pedicelli* circa 1 cm. longi. *Sepala* oblonga, obtusa, 1 cm. longa, 3 mm. lata. *Petala* oblonga, obtusa, 1 cm. longa, sepalis paullo breviora. *Labellum* sessile, oblongum, integrum, concavum, apice emarginatum vel brevissime bilobum, 1 cm. longum, 4 mm. latum, infra medium paullo dilatatum ; discus obscure 4-lamellatus, lamellis ecristatis. *Columna* lata, 5 mm. longa. *Geodorum sp.*, Burkill in Journ. Linn. Soc. xxxv. p. 56.

POLYNESIA. Tonga Islands, Vavua, *C. S. Crosby* ; Solomon Islands, *C. M. Woodford*.

A drawing sent by Mr. C. M. Woodford from the Solomon Islands, represents the sepals and petals rose-pink, and the lip closely veined with crimson on a white ground, with the veins somewhat confluent in front, and the disc bright yellow.

307. **Polystachya Smytheana**, *Rolfe* ; affinis *P. elasticae*, Lindl., sed triplo brevioribus, et labelli ungue et limbo duplo brevioribus facile distinguenda.

Herba epiphytica, circa 5 cm. alta. *Rhizoma* validum. *Pseudobulbi* approximati, ovati, 6–8 mm. longi. *Folia* non vidi. *Scapi* erecti, circa 4 cm. longi, puberuli, basi vaginis lanceolatis acutis striatis imbricatis obtecti, circa 4–6-flori. *Bracteae* patentes, latissime ovatae, apiculatae, denticulatae, 1·5–2 cm. longae. *Pedicelli* 6–8 mm. longi, sparse puberuli. *Flores* mediocres, pallidi, labello roseo-suffusi medio pulvino flavo ornato. Sepalum posticum elliptico-oblongum, obtusum, concavum, prope apicem in dente subulato productum ; sepala lateralia latissime triangulari-ovata, mucronata, 5 mm. longa, 8 mm. lata. *Petala* elliptico-oblonga,

obtusa, 5 mm. longa. *Labellum* breviter et late unguiculatum, trilobum, circa 1 cm. longum, infra medium reflexum; lobi laterales oblongi, subobtusi, 1·5 mm. longi; lobus intermedius late unguiculatus, orbiculari-reniformis, obtusus, paullo undulatus, circa 7 mm. latus; isthmus 5 mm. longus, 3 mm. latus, medio constrictus, margine undulatus; disci pulvinus oblongus, 3 mm. longus. *Columna* lata, 2 mm. longa.

SIERRA LEONE. *C. W. Smythe*, 56.

308. **Polystachya liberica**, *Rolfe*; a *P. Smytheana*, Rolfe, scapis robustioribus, floribus majoribus et labelli isthmo latiori differt.

Scapi erecti, 8–9 cm. longi, pubescentes, basi vaginis lanceolatis acutis striatis imbricatis obtecti, circa 10–14-flori. *Bracteae* patentes, latissime ovatae, apiculatae, denticulatae, concavae, 1·5–2 mm. longae. *Pedicelli* 6–10 mm. longi, pubescentes. *Flores* mediocres, pallidi, labello roseo-purpureo medio pulvino flavo ornato. *Sepalum* posticum elliptico-oblongum, apiculatum et prope apicem in dente subulato productum, 1 cm. longum; sepala lateralia latissime triangulari-ovata, mucronata, 6 mm. longa, 7 mm. lata. *Petala* oblonga, obtusa, 5 mm. longa. *Labellum* breviter et late unguiculatum, trilobum, circa 1 cm. longum, basi concavum, infra medium reflexum; lobi laterales oblongi, apiculati, fere 2 mm. longi; lobus intermedius late unguiculatus, transverse oblongus, obtusissimus, circa 7 mm. latus; isthmus 5 mm. longus, 4 mm. latus, margine undulatus; disci pulvinus elliptico-oblongus, 3–4 mm. longus. *Columna* lata, 2 mm. longa.

LIBERIA. *Sir H. H. Johnston.*

The two preceding species are allied to *P. elastica*, Lindl., a native of Sierra Leone, which for a long period was unique in the genus on account of the elongated reflexed limb of the lip. One other has since been described, namely *P. epiphytica*, De Wild., a native of the Congo district.

309. **Stauropsis Woodfordii**, *Rolfe*; habitu *S. Warocqueanae*, Rolfe, sed floribus duplo minoribus facile distinguenda.

Caules erecti, subelongati. *Folia* disticha, laxa, patentia, oblonga, obtusa, 9–11 cm. longa. *Scapi* erecti, circa 30 cm. alti, paniculati; panicula ampla, multiflora; rami 6–8 cm. longi. *Bracteae* patentes, obovato-oblongae, obtusae, concavae, circa 5 mm. longae. *Pedicelli* crassiusculi, circa 1 cm. longi. *Flores* carnosi, gilvi, brunneo-maculati. *Sepala* patentia elliptico-oblonga, obtusa, 8–10 mm. longa. *Petala* patentia, obovata, obtusa, sepalis paullo breviora. *Labellum* trilobum, circa 8 mm. longum; lobi laterales lati, brevissimi, obtusi; lobus intermedius lateraliter compressus, acutus, carinatus, prope basin callo erecto instructus; calcar brevissimum. *Columna* crassa, circa 2 mm. longa.

SOLOMON ISLANDS. New Georgia, *Officers of H.M.S. Penguin*; Ysabel Island, *C. M. Woodford.*

310. **Sarcochilus solomonensis**, *Rolfe*; a *S. Engleriano*, Kränzl., floribus majoribus, petalis sepalis angustioribus omnino liberis, calcari oblonga differt.

Caulis brevis, erectus. *Folia* disticha, recurva, oblonga, oblique bidentata. *Scapi* penduli, circa 30 cm. longi; racemi circa 15 cm. longi, multiflori. *Bracteae* patentes, triangulari-ovatae, acuminatae, 2–3 mm. longae, basi concavae. *Pedicelli* patentes vel reflexi, graciles, 1–5 cm. longi. *Flores* gilvi, brunneo-punctati. *Sepala* subpatentia, unguiculata, 1·2–1·5 cm. longa, limbus late ellipticus, obtusus. *Petala* subpatentia, unguiculata, sepalis paullo minora. *Labellum* unguiculatum, trilobum, circa 6 mm. longum; unque lineari angustissimo, lobis lateralibus patentibus falcato-oblongis obtusis, lobo intermedio minuto, disco tuberculo minuto instructo, calcari erecto oblongo obtuso. *Columna* oblonga, circa 2 mm. longa.

Solomon Islands. Tulagi, *C. M. Woodford.*

Described from an inflorescence and from a photograph of the whole plant. It is said to be common throughout the Solomon Islands.

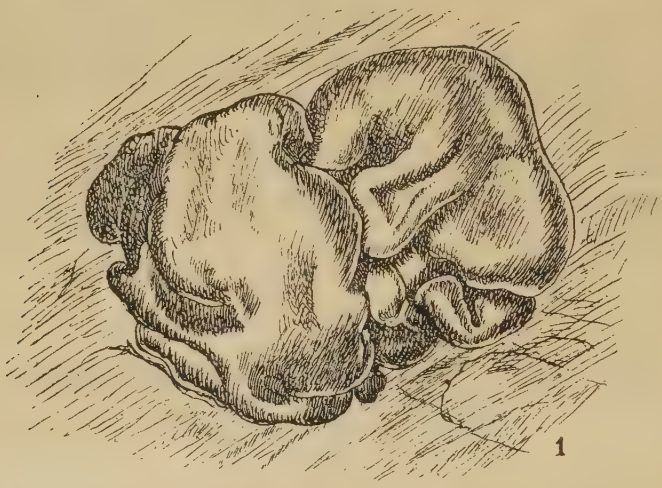
XII.—THE APPEARANCE OF COLPOMENIA SINUOSA IN BRITAIN.

A. D. Cotton.

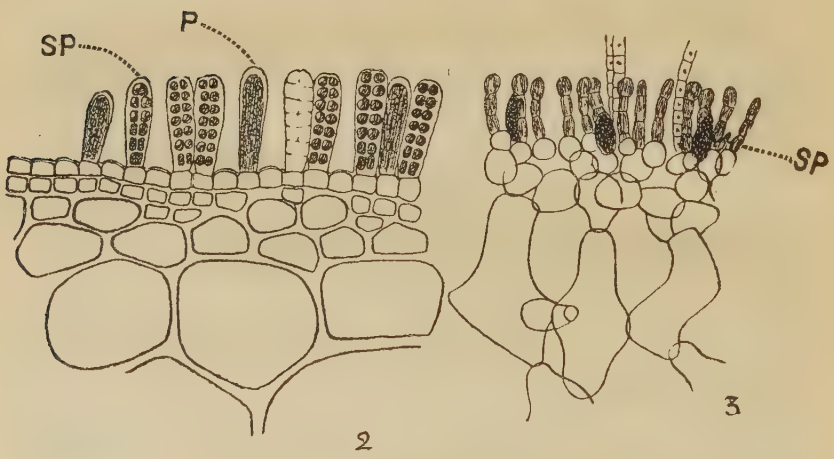
Colpomenia sinuosa, Derbes & Sol., a Brown Alga of the family *Encoeliaceae*, is a plant that is found throughout the warmer seas, being known both from the tropics and from temperate regions. It occurs abundantly in the Mediterranean, but until recently has not been recorded in Europe farther north than Cadiz. In 1906 two French observers drew attention to the appearance of *Colpomenia sinuosa* on the S.W. coast of Brittany, and during 1907 further notes were published on its occurrence at various localities in the neighbourhood of Cherbourg. Its presence may now be chronicled on the coasts of Britain, specimens having been collected by Mr. E. M. Holmes at Torquay in September, 1907, and by the writer at Swanage in the previous April. The appearance in these regions of an alga not previously known nearer than the south of Spain is of considerable interest, especially when it is not a question of isolated individuals, but of the apparent establishment of the plant in several widely separated localities. *Colpomenia sinuosa* is moreover of importance from an economic standpoint, in that it may occasion considerable damage to the oyster industry.

Though frequent in the Mediterranean, and well known from other parts of the world, a complete account of *Colpomenia sinuosa* has never been published. For this reason it was not without some hesitation that the British plants were referred to that species, especially as they did not altogether agree with such descriptions as had previously appeared. Specimens were therefore submitted to M. Bornet who has been kind enough to examine them and to confirm the identification. The Torquay specimens agree in a general way with the account furnished

by Miss Mitchell (1), which is the fullest hitherto published; there are however several variations from the description given by that writer. These variations may possibly be explained by differences in age and in the season of collecting. It is hoped that, when the investigation of the structure and development is complete, it will be possible to publish a full account elsewhere.



1



2 3

Fig. 1. COLPOMENIA SINUOSA. Derbes & Sol. Natural size, (after Oltmanns).

Fig. 2. COLPOMENIA SINUOSA. Portion of section of fertile plant, showing pseudoparenchymatous structure. *Sp.* = plurilocular sporangia. *P.* = paraphyses. × 400.

Fig. 3. LEATHESIA DIFFORMIS, Aresch. Section through portion of a fertile plant showing the structure, which is not pseudoparenchymatous but more or less filamentous. *Sp.*=Unilocular sporangia. × about 200, (after Thuret).

In external form *Colpomenia sinuosa* resembles *Leathesia difformis*, a species with which it has often been confused. It may be distingushed from that plant by the thinner non-gelatinous

walls, and by the structure, which is cellular and not filamentous. *Leathesia* also is usually irregularly lobed even when quite young, and has a resiliency which is lacking in *Colpomenia*.

The history of the appearance of *Colpomenia sinuosa* on the West Coast of France and in the English Channel is as follows. In 1906, M. Fabre-Domergue, Inspector-General of Marine Fisheries, recorded (2) the appearance of a seaweed at Vannes, in the Gulf of Morbihan, which caused the oyster-cultivators considerable anxiety. The plant was determined by Bornet to be *Colpomenia*. Fabre-Domergue states that the cultivators gave the seaweed the name of "Ballons" from the fact of their becoming, after exposure to the atmosphere at the lowest tides, partially filled with air, and floating to the surface of the water at the return tide. Considerable damage was done to the oyster-beds by the "ballons" not infrequently bringing with them to the surface the young oysters amongst which they had been growing. The author quotes a communication from Bornet, stating that the alga was not positively known to occur north of Cadiz, and that records of its presence on the North Coast of Spain are unreliable, especially as *Leathesia*, which is found on that coast, is not cited in Lazaro's catalogue. Amongst methods employed by the oyster-cultivators to destroy *Colpomenia*, the only one which had been in any measure successful, was that of breaking the "ballons" by sweeping the oyster-beds with bundles of prickly branches ("fagots épineux"). Fabre-Domergue suggested that the special conditions of Vannes in the Gulf of Morbihan were favourable to the growth of this southern species, but that after the first severe winter it would probably disappear.

At the end of the same year Sauvageau (3) published a paper on the occurrence of *Colpomenia* on the oyster-beds of the river Vannes, and recorded it from Belle Isle and Quiberon, two new localities in the same neighbourhood. From its distribution and abundance, the author believed that it had been introduced several years previously and had already become acclimatised. The floating of the alga is explained by Sauvageau in the following manner. "Le *Colpomenia* très jeunes est massif ; il se creuse en augmentant de volume. Il a une base étroite qui est son point d'attache ; soit par désorganisation localisée, soit par suite de l'irrégularité du support, cette base présente des ouvertures par lesquelles l'eau s'écoule. Au retour du flot, l'eau pénètre dans l'Algue par dessous, emprisonne l'air et constitue le ballon, qui est capable de soulever un support non fixé. Normalement, le *Colpomenia* étant adhérant au rocher, ou à des Algues fixées, n'est pas transporté par le courant comme celui de la Rivière de Vannes." Sauvageau also remarks that the method of breaking the "ballons" though efficacious in preventing the tendency to float is neither curative nor preventive, in fact the reverse, since the sporangia-bearing fragments of the algae are borne away by the currents and dispersion promoted. The number of oysters carried away from the beds is considerable, at times so much so, that the cultivators take the trouble to recapture them with nets.

In the beginning of April, 1907, *Colpomenia* was collected by several botanists in the neighbourhood of Cherbourg. Corbière (4) published a note on the subject, and added in a postscript that

he had seen a dried specimen from the same locality collected in March of the previous year. Bornet confirmed Corbière's identification. Two further notes were published by Mangin (5 and 6), who recorded the plant from several additional stations (Gatteville, Tatihou, and Barfleur). His specimens were collected on March 31, and April 1, 1907. Mangin also states that M. Malard, Assistant Director of the Marine Laboratory of the Tatihou Museum, informed him that the alga was first observed in September, 1905. Fauvel (7) also noted the occurrence of the plant in the same neighbourhood.

In September, 1907, the writer received from Mr. E. M. Holmes some dried specimens of an alga like *Leathesia* collected at Torquay, with a request to examine its structure. Mr. Holmes stated that the plant was quite distinct from *Leathesia*, and suggested a *Colpomenia* affinity. The specimens were immature, and, except for a minute fragment, sterile. The plant occurred fairly plentifully at Torquay, being found as an epiphyte on *Corallina*, *Rhodymenia palmata*, etc., and later supplies afforded fertile material. The first of these was a fine specimen about the size of a tennis ball, the remainder, which have been sent at intervals during the autumn, have been smaller. The fertile material showed the general structure of *Colpomenia sinuosa*, though the sporangia differed somewhat in size and other details from those of published descriptions, and also from the slides in the British Museum prepared by Miss Mitchell and illustrative of her paper. Later consignments from Torquay being similar to the previous gatherings, specimens were sent to M. Bornet who agrees that the plant is the Mediterranean *C. sinuosa*, the alga which has invaded the coasts of Normandy and Brittany. The immature specimens sent by Mr. Holmes immediately recalled to the writer some small plants noted by him at Swanage on April 27th, 1907. The specimens, which fortunately had been preserved, prove on examination to be identical with Mr. Holmes's plant, and undoubtedly represent young plants of *C. sinuosa*. On gathering, they were doubtfully referred to young stages of *Leathesia*, with a note that the walls were very thin and non-gelatinous. At Swanage, as at Torquay, the plant occurred as an epiphyte.

From the above account, it will be seen that *Colpomenia sinuosa* appears to have thoroughly established itself in the waters of the English Channel. On the British shores, as on the coast of France, it has appeared at localities widely separated from each other, and that in considerable quantity. The localities from which it has been recorded are well-known hunting grounds for algae, and therefore frequently visited, and were other intervening places to be searched, it is possible that it would be found in them also. As to the manner and date of its arrival on the shores of Britain, definite evidence is not yet forthcoming. The writer spent a week at Swanage studying and collecting algae in April, 1906 without any trace of *Colpomenia* being observed. If the invader, as suggested by Sauvageau, were introduced to the coasts of Brittany some years ago and has since been spreading in an easterly direction, it is possible that it may have first established itself at Swanage during the winter of 1906–7. Currents may have played an important part in its advance. On the other hand,

it may have been directly introduced to our shores by vessels; or conceivably with the consignments of young oysters that are imported from France to be "fattened" on the British culture-grounds, from whence it may have travelled along the coast.

The naturalisation of a marine alga on foreign shores is interesting and uncommon. Cases are known in which algae have been introduced and may now be found settling down and slowly spreading in the immediate vicinity. The Japanese *Bonnemaisonia hamifera* is a case in point. This alga is confined to certain spots on the south coast of England, and is found in very small quantity only. With *Colpomenia* it is otherwise. For over a century it has been recognised from the Mediterranean region, but, as far as known, has not during that period spread in a northerly direction. By some means it has now appeared in various localities in France and England, where it thrives and spreads rapidly, the external conditions appearing to be perfectly suitable to vigorous growth. The presence of warm currents due to the Gulf Stream would probably account for a southern alga being able to flourish in the English Channel, though it is not easy to see why *Colpomenia* should not have spread previously along the coasts of Spain and Portugal, which receive the full benefit of the Gulf Stream. M. Bornet, in a letter to Mr. Holmes, suggests that *Colpomenia* has been brought to Vannes by the vessels that convey living lobsters from Portugal to be cultivated in the Gulf of Morbihan. This explanation is possible enough, although as noted above there is no certain record that the plant occurs on the Portuguese coast.

Literature.

1. Mitchell, M. O. On the structure of *Hydroclathrus*, Bory. Murray's Phycological Memoirs, Part ii. 1903. pp. 53–57. Plates XIV. and XV.

2. Fabre-Domergue. Une invasion d'Algues méridionales (*Colpomenia sinuosa*) sur les huîtres de la rivière de Vannes. Comptes Rendus, CXLII. 1907, pp. 1223–1225.

3. Sauvageau, C. A propos du *Colpomenia sinuosa* signalé dans les huîtrières de la rivière de Vannes. Bulletin scientifique d'Arcachon, IX. 1906, pp. 35–48.

4. Corbière, L. Sur l'apparition à Cherbourg du *Colpomenia sinuosa*. Bull. de la Soc. Bot. de France, LIV. 1907, pp. 280–283.

5. Mangin, L. A propos du *Colpomenia sinuosa*, (Roth) Derb. et Sol. Bull. de la Soc. Bot. de France, LIV. 1907, pp. 283–284.

6. Mangin, L. Sur l'existence du *Colpomenia sinuosa* dans la Manche. Comptes Rendus Soc. Biol. Paris, LXII. 1907, pp. 793–795.

7. Fauvel, P. Sur la présence du *Colpomenia sinuosa* à Cherbourg. La feuille des Jeunes Naturalistes, 1907, p. 146.

XIII.—PATCHOULI.

(*Pogostemon Patchouli*, var. *suavis*, Hk. f. = *P. Cablin*, Benth.)

Patchouli has already been the subject of several articles in the *Kew Bulletin*. The earliest notice [K.B. 1888, p. 71] deals mainly with the source of commercial Patchouli; the second [K.B. 1888, p. 133] and third [K.B. 1889, p. 135] are chiefly concerned with the cultivation of the plant and the trade in Patchouli; the latest [K.B. 1902, p. 11] discusses the identity and range of distribution of another plant, *Microtoena cymosa*, Prain, which has the same odour as the Patchouli of commerce.

In the first of these notices of Patchouli is given the text of a letter [K.B. 1888, p. 73] addressed by Kew to the Government of India on 30th January, 1888, in which the information then available and the points still requiring elucidation are clearly and precisely put.

As that letter states the true Patchouli plant is free from ambiguity; it is the *Pogostemon Patchouli* described and figured by Sir William Hooker in the Kew Journal of Botany, vol. i., p. 328, t. 11, from cultivated specimens. This stands in the Flora of British India, vol. iv., p. 634, as *P. Patchouli*, var. *suavis*. The letter further records an opinion expressed by Professor D. Oliver that it is doubtful whether this particular form, which is the economic plant of commerce, be indigenous in any part of India. This opinion has, since 1888, been fully confirmed. The economic Patchouli plant, which is abundantly cultivated in the Straits Settlements, almost exclusively by Chinese immigrants, is an exotic so far as India is concerned. The plant occurs in the chief Botanic Gardens in India and Ceylon, but in private gardens, whether native or European, it is practically unknown. It was introduced to the Royal Botanic Garden at Calcutta in 1834, when Dr. Wallich received plants from Mr. G. Porter, then in charge of the Botanic Garden at Penang. At Calcutta the plant has never flowered, though descendants of the original plants, vegetatively propagated, still exist and thrive there. It has never flowered in the Botanic Garden at Saharanpur, where it was introduced from Calcutta. At the Royal Botanic Garden, Peradeniya, Dr. Trimen informed the writer it had not flowered during his directorship, and there was no record of its having flowered before his arrival in Ceylon. At Singapore, according to Mr. Hullett, no one had ever heard of its flowering; the evidence adduced by Mr. Wray [K.B. 1889, p. 136] points to its never having flowered at Penang or in Perak during the preceding 30 years. There are specimens at Kew which show that this plant is, or has been, in cultivation in Java and in Mauritius; in these islands also it appears never to flower. But there is no definite record of its cultivation on a commercial scale anywhere save in Penang and Perak.

There was no evidence in the Kew Herbarium in 1888, and there still is none, of the existence of any form of *Pogostemon Patchouli*, scented or scentless, in the Khasia or Assam region. The same was then and still is true of the Calcutta Herbarium. But the same is still true, as regards both Herbaria, of China, so

that the additional suggestion made in 1888 by Professor Oliver, that the Patchouli plant of commerce may have originated in China, still lacks confirmation. Such a suggestion, seeing that the Patchouli plant of commerce is cultivated by the Chinese in the Straits Settlements, was certainly an extremely natural one to make. It now seems unlikely, however, that it may ever be confirmed. Not only has no *Pogostemon* with the Patchouli odour been reported from China; we are now aware that, though Patchouli is well known in China, the Chinese Patchouli plant is neither the Patchouli plant of commerce nor the Indian Patchouli plant, but is the plant with the Patchouli odour alluded to in the Kew Bulletin for 1888 as occurring in Khasia and Assam.

This latter plant, *Microtoena cymosa*, Prain, has been already dealt with [K.B. 1902, p. 11], and it is only necessary to repeat here that it is a Chinese species which seems to have spread southward, as a cultivated plant, to Manipur and the Khasia Hills in Assam and to the Shan States of Burma and Siam. There is, indeed, an isolated record of its having reached Java, not improbably as an importation by Chinese settlers; its cultivation there has not, however, persisted, and there is no indication that it ever reached Sumatra, Borneo or the Malay Peninsula.

It was pointed out [K.B. 1888, p. 74] that if this plant has the true odour it may have a commercial use in India. We know now that it possesses the distinctive odour in as marked a degree as the Patchouli plant of commerce itself. We know besides that though it is not now used commercially in India there was a time when this was the source of the Patchapat sold in the Calcutta market, in contradistinction to the market of Bombay, where at one time the Patchapat offered for sale was derived from a cultivated state of *Pogostemon Heyneanus*. In both markets, however, the Patchapat—Patchouli leaf—formerly sold has now been almost if not quite replaced by the leaf of the Patchouli plant of commerce, imported from the Straits Settlements. The cultivation of *Microtoena cymosa* lingers still in native gardens in the Khasia Hills, where its product is locally used; and that of *Pogostemon Heyneanus* is similarly continued in native gardens throughout the Indian Peninsula from the Concan and Berar southward to Coimbatore.

This latter possibility was fully anticipated in the earliest notice of Patchouli in this Bulletin [K.B. 1888, p. 74]. The scented cultivated form in question differs from the feral states of the plant, mentioned in the same place as being of common occurrence in the Western Peninsula of India from Bombay southward, chiefly in having leaves that are of a slightly thicker consistence. These feral states, of which there are two, both extending to Ceylon, are not clearly indigenous in any part of India. One form, much more frequently met with than the other, was described by Bentham in 1830 as *Pogostemon Heyneanus*—he had used the name for the first time [Wall. Cat. Lith. 1532] two years previously. The other form was later distinguished by Bentham as *P. Heyneanus*, var. *β*.

The more plentiful of the two forms is not, however, confined to India and Ceylon. It is not uncommon in Java, Sumatra, and Borneo; in the Malay Peninsula it has been collected in

almost every province. So far it does not seem to have been recorded from any Malay locality to the east of Borneo, but what may be another form of the species occurs in the Southern Shan states of Burma, side by side with the Chinese *Microtœna cymosa*, and the commoner Indian and Malayan form has more recently been found in the Philippine island of Mindanao, though as yet nowhere else in that group. When the nature of its habitat has been noted, whether in India, Malaya, or the Philippines, the records are very uniform; it is stated to occur in exposed sunny waste places; in waste ground near villages; at or near cleared camping grounds; near sites of abandoned dwellings; or in native gardens. The form that occurs in native gardens in India and Ceylon is also met with in gardens in Java; the same form has also been collected in Tonkin. So far, however, it has not been reported from Sumatra, the Malay Peninsula, or Borneo.

Though the name Patchapat—Patchouli leaf—is probably applied indifferently in Indian bazars to any leaf that has the characteristic Patchouli odour, there is no doubt that in Indian gardens in which the plant is grown the vernacular names Patchouli and Patcha are applied exclusively to the *scented cultivated state* of *P. Heyneanus*, with leaves rather thicker than those of the wild plant. The name *P. Patchowli*, which was first applied to *P. Heyneanus* by Dalzell and Gibson [Flor. Bomb. Addend. p. 66] in 1861, and was subsequently adopted in the Flora of British India, vol. iv., p. 633, is on this account very appropriate. Unfortunately, however, the name *P. Patchouli* cannot be employed for the plant to which the vernacular term Patchouli is alone applied; first, because the Indian plant known to the natives as Patchouli or Patcha had already been named *P. Heyneanus* in 1828; again, because the name *P. Patchouly*, which was used by Pelletier for the first time in 1844, was not applied by him to the plant known in the Indian vernaculars as Patchouli, but was given to the Patchouli of commerce, which is not an Indian plant at all.

This Patchouli of commerce, as already explained, stands in the Flora of British India as *Pogostemon Patchouli*, var. *suavis*. Now, however, that fuller material is available, it is found that the two Pogostemons which possess the Patchouli odour, viz.:—*P. Heyneanus*, Benth., or *P. Patchowli*, Dalz. & Gibs., the cultivated plant known in Indian native gardens as Patchouli, and *P. Patchouli*, var. *suavis*, the Patchouli of commerce, are even more distinct than they were thought to be when the account of the genus *Pogostemon* was drawn up for the Flora of British India. They admit of being treated as specifically separable. In *P. Heyneanus* the leaves are much thinner and are sparingly puberulous, or almost smooth; the flowers, which are freely produced in all the countries in which the plant has been found, are in small whorls less than half an inch across, separated by distinct interspaces throughout the spikes in which they are arranged; the corolla is glabrous outside except for a few hairs on the margin of the lower lip. In the Patchouli plant of commerce the leaves are thicker and firmer, and are densely pubescent, especially beneath; the flowers, which are freely produced only in the Philippines but which have occasionally

been met with also in European cultivated specimens, are in larger whorls, three-quarters of an inch across, which are contiguous throughout the spikes in which they are arranged, or have only the lowest whorl separated by an interspace from the rest of the spike; the corolla is uniformly pubescent outside.

The Patchouli plant of commerce has been differently named by different authors. Tenore, who flowered it in Italy in 1847, described it [Giorn. Bot. Ital., vol. ii., p. 56] as *P. suavis*. Sir William Hooker, who had received a plant of *P. suavis*, Ten., which flowered at Kew in 1849, described it as *P. Patchouli*, under the impression that it was in reality identical with the plant described by Pelletier, with whom it had flowered in France in 1844, as *P. Patchouly* [Mem. Soc. Sc. Orleans, vol. v., p. 277, t. 7]. The identity of *P. suavis*, Ten., with *P. Patchouly*, Pellet., was not admitted in the Flora of British India, and in that work it has been suggested that the plant to which Pelletier's description applies is the cultivated plant to which the Indian vernacular name Patchouli belongs, rather than the plant which yields the Patchouli of commerce. Now, however, that better material of the Patchouli plant of commerce has reached Kew from the Philippines, where it is sometimes grown in gardens, and where, as Mr. Merrill has recently ascertained, it is oftener wild, and is undoubtedly indigenous, it is found that Sir William Hooker's conclusions are certainly right. His identification of *P. suavis*, Ten., with *P. Patchouly*, Pellet., and his treatment of this plant as a quite distinct species, must both be sustained.

We are, however, fortunately relieved of the necessity of using for the Patchouli of commerce the name *P. Patchouly*, applied to it by Pelletier. In the Philippines, where the plant is native, it bears the vernacular name Cablan. This name was taken up by Blanco, who described the plant for the first time under the name *Mentha Cablin*. The plant was duly transferred by Bentham to its proper genus as *Pogostemon Cablin*. Bentham has thus provided a name for the Patchouli of commerce which has the double advantage of being botanically admissible and at the same time free from ambiguity.

So far then as Patchouli is concerned one or two points appear still to be obscure. It is not clear where the plant known to the natives of India as Patchouli or Patcha is indigenous, though on the whole it is probably a native of the western portion of the Indian Peninsula, as suggested in the *Kew Bulletin* for 1888, p. 74. Nor is it clear when the wild Philippine species, which is the source of the Patchouli of commerce, first began to be cultivated, or how this plant should have found its way into the hands of the Chinese immigrants who cultivate it in the Straits Settlements.

Two adulterants are mentioned by Wray [K. B. 1889, p. 137] as being added to commercial Patchouli. One of these, Perpulut, elsewhere [K. B. 1888, p. 72] termed Bupulut, is correctly given as *Urena lobata*, Linn. The other, Ruku, is stated to be *Ocimum Basilicum*, Linn., var. *pilosum*, Benth. To some extent this plant does appear to be so employed. But the name Ruku, as a rule, is not applied to *O. Basilicum*, but to *Hyptis graveolens*, Poit. In

pointing out this minor error in an article so valuable as that of Wray, it has to be added that the mistake is one for which Wray is not responsible, but is the result of imperfect diagnosis of the samples of detached leaves and fruiting calyces of Ruku supplied for identification.

XIV.—MISCELLANEOUS NOTES.

Rumpenheim Lilac.—For very many years there grew in the gardens of Cambridge Cottage at Kew (the residence of the two last Dukes of Cambridge) a pair of lilacs of somewhat unusual character. They have each formed a clean single trunk and have never produced sucker growths from the roots as lilacs mostly do. The trunk of the larger one is 4 feet 2 inches high and 2 feet in girth, and the flaky bark has the spiral arrangement, frequently seen in lilacs, very markedly shown. These plants are merely *Syringa vulgaris*, but the tree-like character is not common in this country. It may possibly be due to their having been raised from seed, and not from cuttings as is usually the case.

Besides their unusual appearance, these lilacs have a certain historical interest. They had both been brought from Rumpenheim-on-the-Main near Frankfort, a favourite palace of the Hesse Family. This place is frequently mentioned in Sheppard's *Private Life of the Duke of Cambridge*, from which work we learn that it was bequeathed by the Landgrave Frederick of Hesse to his children jointly. He also expressed the wish that they and their children should assemble there every second year. This desire was faithfully fulfilled. As long ago as 1837 when the late Duke was but 17 years of age, he wrote "I am delighted to be once more at dear old Rumpenheim." He made his accustomed pilgrimage to Rumpenheim for the last time on August 25, 1903, less than a year before he died.

With the death of the Duke in 1904 Kew ceased to be a place of royal residence, a distinction it had possessed since 1730, when Frederick Prince of Wales and his consort Augusta came to live at Kew House. Cambridge Cottage has now been given over by His Majesty the King for public use. These two lilacs have always been objects of peculiar interest to the Royal Family, especially to the descendants of the Landgrave Frederick above mentioned. H.R H. The Princess of Wales, who is his great grand-daughter, expressed a desire that one of them should be transferred to the gardens at Windsor. This was accordingly done in 1905. The other and larger one, which was growing in an unfavourable position, was removed on December 23, 1907, to the lawn in front of Kew Palace, a building which has even longer associations with the Royal Family than Cambridge Cottage.

Presentations to Museums.—The Royal Servian Commissioner for the Balkan States Exhibition, held at Earl's Court during 1907, has presented to the Museum a collection of 41 sections of trunks of Servian timber trees, also stems of flax and hemp grown in Servia, and hempen rope. [*See* Cases 17 and 110, Museum No. I.]

Mr. C. W. Anderson, Government Land Department, British Guiana, has presented :—1. Ball of Native spun cotton wrapped in leaf (undeterminable), spun by Wai-Woi Indians. [*See* Case 13, Museum No. I.] II. Arrow points poisoned with Wourali (*Strychnos toxifera*), used by Wai-Woi Indians, sources of Essequibo River, British Guiana. [*See* Case 79, Museum No. I.]

Messrs. J. H. Vavasseur & Co., Ltd., 4, Lloyd's Avenue, E.C., have presented a series of samples of desiccated Cocoa-Nut. [*See* Museum No. II., Room V., Table Case.]

Lady Hindlip has presented the following specimens collected by her in British Columbia :—I. *Sphagnum acutifolium*, Cassiar district, used by Indian women for wrapping up their babies. II. Dried plant of *Veratrum viride* from Wrangell, Alaska. The root is used by the Indians for the preparation of snuff.

Mr. W. Crosley, 65, Addison Road, W., has presented specimens of the nest of a Weaver bird collected by him in the Republic of Colombia. The nests are made of the leaves of a grass or sedge which are indeterminable. They were accompanied by a drawing by the donor, made from sketches taken on the spot, shewing the situation of the nests on the somewhat bare and extended branches of the taller trees. When sending the nests Mr. Crosley wrote as follows :—

"I am afraid I can't give give you much information as to the bird's habits. Its choice of a nesting place seems to be governed by the consideration of isolation and freedom from possibility of entanglement. A rather bare extended branch of a living tree, away from creepers and parasites, so that the swinging in a high wind would be harmless.

"I have no knowledge of any preference that they may show for any particular species of tree, but I do seem to recollect that they avoid the 'Ceiba' (which is the equivalent of the cottonwood tree of West Africa) as I never saw nests attached to that tree, although it is the giant tree of those forests, often running up to considerably over 100 feet before branching. The 'Ceiba' is considered more or less poisonous by the natives, whether from the dropping of the flowers and cotton, or from the effect of the roots, I don't know. Anyhow, water springing from near such trees or lying around them is considered 'Agua malsana.'"

For the specimens *see* Table Case, Room VII., Museum No. II.

J. M. H.

Additions to the Herbarium during 1907.—Over 12,000 sheets were presented or sent in exchange by about 120 persons and institutions, while over 7,000 sheets were purchased. The principal collections are enumerated below. Except where otherwise stated or implied, the collections purchased are named, and those presented are unnamed or only partially named.

VARIOUS PARTS OF THE WORLD. *Presented:*—Botanical collections of the late Dr. M. T. Masters, F.R.S., presented by Mrs. Masters; duplicates, mainly Tropical American, by the Royal

Botanic Garden, Berlin ; collection of Ferns of the late John Day, by Mrs. Coke ; Gossypium, by Sir G. Watt ; Dioscorea, by the Department of Public Gardens and Plantations, Jamaica.

Purchased :—Kneucker, "Cyperaceae et Juncaceae Exsiccatae," lief. vi. ; "Gramineae Exsiccatae," lief. xxi.–xxii. ; C. F. Baker, "Economic Plants of the World," fasc. i.

EUROPE. *Presented :*—"Kryptogamae Exsiccatae," Cent. xiv., by the Imperial Natural History Museum, Vienna ; "Hieraciotheca Gallica et Hispanica," fasc. xvii.–xviii., by Messrs. Arvet-Touvet and Gautier ; "Plantae Finlandiae Exsiccatae," fasc. i.–viii., by the Botanical Museum, University of Helsingfors ; "Lichenes florae Rossiae Exsiccatae," fasc. i.–ii., by the Imperial Botanic Garden, St. Petersburg ; "Rosliny polskie," Cent. i.–ii., by Dr. M. Raciborski ; "Musci Galliae," concluding fascicle, by Mr. T. Husnot ; slides of British Florideae, by Mr. A. D. Cotton ; Juglans and Populus, by Mr. L. A. Dode.

Purchased :—Sydow, "Mycotheca Germanica," fasc. x.–xiii. ; Adamovic, Balkan Peninsula ; Dahlstedt, "Herbarium Hieraciorum Scandinaviae," Cent. xx.

NORTH AFRICA AND ORIENT. *Presented :*—"Plantae selectae ex Africa boreali," fasc. i., by Dr. Sv. Murbeck ; Western Persia, by Mr. Th. Strauss.

Purchased :—Bornmüller, Persia and Asia Minor.

EASTERN ASIA. *Presented :*—Named specimens, by the Natural History Museum, Paris ; by the Imperial Botanic Garden, St. Petersburg ; Chinese and Malayan Ferns, by Fleet-Surgeon C. G. Matthew.

INDIA AND MALAYA. *Presented :*—Scarce Bombay plants, by Dr. T. Cooke, C.I.E. ; Pulney Hills, Madras, by Dr. A. G. B. Bourne ; Burma, by Mr. J. H. Lace ; India and Tibet, by Mr. I. H. Burkill ; Podostemaceae, by the Royal Botanic Gardens, Peradeniya ; Malay Peninsula, by the Botanic Gardens, Singapore ; named Philippine Orchidaceae and Dipterocarpaceae, by the Bureau of Science, Manila ; Philippine Islands, by Mr. A. Loher.

Purchased :—Philippine Islands, Elmer.

AUSTRALASIA. *Presented :*—Scarce N. S. Wales plants, by the Botanic Gardens, Sydney ; S. Australia, by Mr. J. M. Black ; named Australian Marine Algae, by Mr. A. D. Cotton ; Franc, New Caledonia, named, by Mr. G. Bonati ; Solomon Islands, by Mr. C. M. Woodford, Resident and Deputy Commissioner ; New Zealand, by Mr. C. J. Burgess ; New Zealand Algae, by Mr. R. M. Laing.

Purchased :—Schlechter, New Caledonia.

TROPICAL AFRICA. *Presented :*—By Dr. Auguste Chevalier ; Sierra Leone, named, by Mr. C. W. Smythe ; Gold Coast, by Mr. A. E. Evans ; N. Nigeria, by Col. E. J. Lugard, D.S.O. ; W. R. Elliott, N. Nigeria, by the Imperial Institute ; S. Nigeria, by Mr. R. E. Dennett, by Mr. E. W. Foster, by Mr. A. H. Unwin ; Lagos, by Mr. E. W. Foster ; Sudan, by Mr. A. F. Broun ; Dawe and Brown, Uganda, by Mr. M. T. Dawe ; Somaliland Grasses, by Dr. R. E. Drake-Brockman ; Hutchins and Battiscombe, British

East Africa, by Mr. E. Hutchins ; British East Africa and Pemba, by Miss Barraud ; British East Africa, by Mr. H. Powell ; British Central Africa, by Mr. J. M. Purves ; Rhodesia, by Mr. C. E. F. Allen ; Southern Rhodesia, named, by Miss L. S. Gibbs ; W. H. Johnson, Mozambique, by the Companhia de Moçambique.

Purchased :—Zenker, Cameroons.

Mascarene Islands. *Presented :*—Aldabra, by Mr. H. P. Thomasset ; Seychelles, by Mr. R. Dupont ; Mauritius, by Mr. P. Koenig.

Purchased :—Boncard, Madagascar Fungi.

South Africa. *Presented :*—Schlechter, named, by Dr. H. Schinz ; Transvaal, &c., by the Transvaal Department of Agriculture ; named Transvaal Asclepiadaceae, by Mr. P. Conrath ; Natal, by the Botanic Gardens, Natal.

Purchased :—Pegler, Transkei.

North America. *Presented :*—By Judge J. R. Churchill ; Lindheimer's Texan plants of 1849–51, fasc. v., by the Missouri Botanic Garden ; Hebbasch, Labrador, by Sir W. MacGregor, G.C.M.G., C.B.

Purchased :—C. F. Baker, Pacific slope ; W. W. Eggleston, N.E. United States.

Mexico. *Presented :*—By the United States National Museum.

Purchased :—Palmer, Mexico ; Pringle, Mexico.

West Indies. Jamaica and Bermudas, named, by the New York Botanical Garden.

Tropical South America. *Presented :*—São Paulo, Brazil, by Dr. A. Usteri.

Purchased :—Lehmann, Colombia, &c., unnamed ; Fiebrig, Bolivia ; Hassler, Paraguay, unnamed.

Perhaps the most noteworthy accession was a fine set of partly named French Sudan and Congo plants, comprising over 1,500 sheets, presented by the collector, Dr. Auguste Chevalier. The collection has not yet been examined in detail, but many of the specimens come from regions that were previously botanically unknown or little explored.

Specimens of numerous interesting economic plants were received, amongst which the following may be mentioned :—*Cordeauxia edulis*, Hemsl., a low bush which yields the "yeheb nut" of Somaliland (see *Kew Bull.*, 1907, p. 361) ; *Mascarenhasia elastica*, K. Schum., the Mgoa rubber-tree of East Africa (*l.c.*, p. 283) ; and *Parthenium argentatum*, A. Gray, which yields the Guayule rubber of Mexico (*l.c.*, p. 285).

Telosma, *Coville* (*Prageluria*, N. E. Br.).—The name *Prageluria* was proposed in the *Kew Bulletin*, 1907, p. 325, for the genus which has hitherto been mistaken for *Pergularia*, Linn. It transpires, however, that Coville had in 1905 proposed the name *Telosma* for the same genus (*Contributions from the United States National Herbarium*, ix., p. 384). This name, which appears in an alphabetical descriptive list "The Useful Plants of the Island of Guam," had been entirely overlooked. *Telosma* therefore replaces *Pergularia* in Benth. and Hook. fil. *Genera Plantarum*, ii., p. 773.

N. E. B.

Research in Jodrell Laboratory in 1907:—

Boodle, L. A.—N'hangellite and Coorongite. (Kew Bull., 1907, pp. 145–151.)

Boodle, L. A.—Microscopic Structure of the Ovule of *Juliania adstringens*. (In Hemsley, W. B.—On the Julianaceae: A New Natural Order of Plants; Phil. Trans. Roy. Soc., B., Vol. 199, pp. 185–188, with eight Figs. in text.)

Brandis, D.—Remarks on the Structure of Bamboo Leaves (Trans. Linn. Soc., 2 Ser. Bot., Vol. VII., pp. 69–92, tt. 11–14.)

Hickling, G.—The Anatomy of *Palaeostachya vera*. (Ann. Bot., Vol. XXI., pp. 369–386, tt. 32–33, with four Figs. in text.)

Lawson, A. A.—The Gametophytes, Fertilization and Embryo of *Cephalotaxus drupacea*. (Ann. Bot., Vol. XXI., pp. 1–23, tt. 1–4.)

Lawson, A. A.—The Gametophytes and Embryo of the Cupressineae with special reference to *Libocedrus decurrens*. (Ann. Bot., Vol. XXI., pp. 281–301, tt. 24–26.)

Massee, G.—Plant Diseases: VII.—"Cluster-cup" Disease of Conifers. (Kew Bull., 1907, pp. 1–3, with one plate.)

Massee, G.—Plant Diseases: VIII.—Degeneration in Potatoes. (Kew Bull., 1907, pp. 307–311, with one plate.)

[Massee, G.]—A Pine Disease (*Diplodia pinea*). (Journ. Board Agric., Vol. XIV., pp. 164–166.)

[Massee, G.]—Clover Sickness. (Journ. Board Agric., Vol. XIV., pp. 223–227, with two Figs. in text.)

[Massee, G.]—Degeneration in Potatoes. (Journ. Board Agric., Vol. XIV., pp. 385–389, with one plate.)

Salmon, E. S.—On a Fungus Disease of the Cherry-Laurel (*Prunus Laurocerasus*, Linn.). (Reprint, 1907, from Journ. Roy. Hort. Soc., Vol. XXXI., 1906, pp. 142–146, with one Fig. in text.)

Scott, D. H. and Maslen, A. J.—The Structure of the Palaeozoic Seeds, *Trigonocarpus Parkinsoni*, Brongniart, and *Trigonocarpus Oliveri*, sp. nov. Part I. (Ann. Bot., Vol. XXI., pp. 89–134, tt. 11–14.)

Worsdell, W. C.—The Origin of the "Flower." Science Progress in the Twentieth Century, Vol. II., pp. 255–262.

Dr. J. Berghs, of the Institut Carnoy, Louvain, studied the cytology of certain fresh-water algae, and especially the cell-division of the Conjugatae.

Mr. L. A. Boodle completed an investigation on the germination of the spores of filmy species of *Todea* under different conditions, the chief point being the comparison of prothalli, produced by germination in closed sporangia, with prothalli grown from free spores. Mr. Boodle continued a study of some anatomical points in the ovule of *Cycas*, and made cultural experiments with a species of *Bromus* and other plants, and investigated the nature of a substance called "N'hangellite." This is a curious product resembling bitumen and apparently derived chiefly from a gelatinous Alga : see above.

Dr. F. E. Fritsch and Miss M. E. Narborough began a series of experiments on the osmotic pressure of the cell-sap in Algae, and other factors affecting growth, &c.

Mr. P. Groom began a research on the occurrence of fat in different Phanerogamous plants.

Mr. W. E. Hiley examined the vascular structure of *Gleichenia pectinata*, and compared it with that of other species, the chief interest of the comparison being due to the fact that *G. pectinata* has solenostelic structure, while all the other species of the genus, as far as is known, are protostelic.

Dr. A. A. Lawson continued his series of investigations on the morphology of the Gymnosperms, and made a special study of the gametophytes and embryo of the Cupressineae. His conclusion, derived principally from a consideration of the presence or absence of certain vestigial structures, is that the Cupressineae do not present as many primitive characters as the Abietineae, but are more primitive than *Cephalotaxus* : see above.

Mr. A. J. Maslen studied the course of the vascular bundles in the ovules of several Cycads.

Mr. W. C. Worsdell continued to collect materials for a general morphological work on Vegetable Teratology ; and also carried on his investigations on the anatomy of Dicotyledons, as a means of elucidating their relationship to Monocotyledons, and determining the nature of the primitive type of structure from which the present vascular structure of both groups of plants has been derived. Mr. Worsdell also made a special morphological and anatomical study of *Paeonia*, with a view to determining the true systematic position of this genus.

Pathology.—During the past year over six hundred reports on plant diseases have been issued. A great number of specimens infected, or suspected of being infected, by American gooseberry

mildew have been submitted for examination. A point of importance in connection with this disease is the fact that the winter fruit or perithecia fall from the shoots during October, in considerable numbers, hence, to secure the greatest benefit from pruning, the work should not be delayed beyond the time indicated, as the spores from the perithecia which fall to the ground may infect young shoots in the following spring.

A series of experiments on certain species of Dodder failed to prove that dredging with calcium sulphide was a destructive measure.

The work bearing on the transmission of disease by means of hibernating mycelium in potatoes has been continued during the past year. On the assumption that the mycelium is often, if not always, present in tubers showing no obvious signs of disease, numerous specimens of apparently sound tubers were specially treated, and a considerable percentage of these have been proved to contain mycelium.

Black scab of potatoes has also been under investigation.

Diseased material has been received for examination at Kew from various British colonies and dependencies.

Botanical Magazine for January.—The plants figured and described are: × *Philodendron Corsinianum*, Makoy, *Paeonia Mlokosewitschii*, Lomakin, *Viburnum utile*, Hemsl., *Herbertia amatorum*, C. H. Wright, and *Pseudolarix Fortunei*, Mayr. The *Philodendron* is remarkable in being the only known artificial hybrid in the genus. Its spathe is about eight inches long, and is brilliantly coloured. The following note on its history, by Dr. A. Ragionieri, Castello, near Florence, Italy, appeared in *Gardeners' Chronicle* for February 1, 1908 :—" × *Philodendron Corsinianum* belongs to a very interesting series of hybrids raised more than 20 years ago in the public gardens of 'Le Cascine,' in Florence, by the foreman, Mr. Ferdinando Ragionieri (now head gardener to H.E. the Prince of Venosa, at Albano, near Rome), and the Director, Cav. A. Pucci. . . . × *Philodendron Corsinianum* is a cross between P. Lindenii ♀ and P. lucidum ♂. It was dedicated to H.E. the Prince Corsini, then Mayor of Florence. The entire stock of the plant was purchased by Messrs. Makoy, of Liege." *Paeonia Mlokosewitschii* is a Caucasian species, and is described as the most handsome of those producing yellow flowers. The plant has recently been introduced into the garden of Mr. W. E. Gumbleton, of Belgrove, Queenstown, where it flowered in May last, and material furnished by it was used in the preparation of the figure. There are now young plants at Kew which were raised from seed received from the Tiflis Botanic Garden. The Chinese *Viburnum utile* has been figured from a specimen grown in the nursery of Messrs. James Veitch & Sons at Coombe Wood. It is a pretty species, distinguished from its allies by its thick leaves which are glabrous above and densely tomentose beneath. The

flowers are white when fully expanded, and are all similar and hermaphrodite. It is expected to prove a valuable addition to the number of hardy flowering shrubs of which so many have been introduced by Messrs. Veitch during the last few years. *Herbertia amatorum* was described for the first time last year (*Kew Bulletin*, 1907, p. 321), from material raised from seed sent to Kew by Dr. C. B. Cantera, of Montevideo, Uruguay. It differs from *H. amoena*, Griseb., and *H. coerulea*, Herb., in having a white obcordate blotch on the claws of the outer perianth-segments. It is the most handsome of the species so far introduced. *Pseudolarix Fortunei* has been in cultivation for many years, seeds having first been sent to England by Fortune in 1853, but it is not common in gardens, and appears to be rare in its native country, China. Fortune found it only in the Province of Chekiang; since his time it has been met with in Kiangsi. The drawing was prepared from a tree which flowered at Kew in June, 1907.

The Red Rust of Tea.—By H. H. Mann and C. M. Hutchinson. (*Memoirs of the Department of Agriculture of India*, Vol. I., No. 6, 1907.)

The disease of the tea plant, known as Red Rust, *Cephaleuros virescens*, Kunze, is of special interest to botanists in that it is one of the few cases in which an alga is parasitic upon a flowering plant.

First observed about 1880, and determined by Cunningham in 1889 to be caused by an algal parasite, Red Rust has during recent years assumed serious proportions. In the latest contribution to the subject several new points are brought to light, a short account therefore of the disease may not be without interest.

Cephaleuros virescens, Kunze, the alga in question, is a member of the *Trentepohliaceae*. That order, although one of the *Chlorophyceae*, is characterised by the possession of haematochromin, a pigment which usually masks the chlorophyll giving the algae an orange or brownish-red hue. Members of the *Trentepohliaceae* are abundant in the tropics, many species occurring as epiphytes on hard-leaved plants, where they frequently enter into combination with fungi to form lichens. In our own country the well-known *Trentepohlia aurea* is a representative of the group.

After an introductory and historical chapter the authors turn to the general effect of *Cephaleuros virescens*, and point out the two distinct forms in which Red Rust is found, viz., the leaf form and the stem form.

On the leaf the alga is usually epiphytic, and the damage occasioned is insignificant; on the stems and branches, on the other hand, it is endophytic, and the effect is more serious. The shoots gradually become unhealthy and die, and, in bad cases, entire trees ultimately succumb.

The details concerning the leaf-form need not be referred to here, the blight in that position being only important as a source

of infection to the stems. The principal features of its development are well known through the work of Cunningham, Ward, and Karsten.

With the form on the young shoots the case is different, and to this the authors pay special attention. The tea plants which are pruned between December and March show no marked sign of disease till the end of March or April, but after the first heavy rains of the season red patches suddenly appear on the young wood. At the same time, or even earlier, the leaves will be seen to lack vigour and to be suffering from chlorosis. The red patches on the stem are due to numerous reproductive bodies of the alga which burst through the bark, and probably represent, as the authors suggest, the last stage of the parasite, infection having taken place the previous rainy season.

Dealing with the spread of the disease, it is pointed out that there are two methods by which the reproductive bodies may be dispersed: (1) wind may convey the sporangia as a whole; and (2) water, in the form of rain or dew, may afford a medium for the distribution of the motile zoospores. The second alternative excites no surprise, water being the natural vehicle for the spread of algal spores. Wind dispersion, on the other hand, may need further explanation. *Cephaleuros* possesses two types of reproductive bodies, gametangia, usually more or less sunk in the thallus, and zoosporangia, which are elevated on sterile hairs. Karsten showed that the zoosporangia ("haken-sporangia") possess a curious mechanism which provides for their detachment. A double ring of cellulose is formed at the junction of the stalk-cell and the sporangium, splitting takes place at this ring which causes the sporangium to be thrown off *in toto*. Dispersion by wind follows and the sporangium, after being moistened by rain or dew, matures and liberates zoospores in the usual manner. That wind distribution takes place by this method in Red Rust is highly probable, but the account given of the germination of the zoospores (pp. 14 and 15) will require confirmation before it will be accepted by botanists in general.

Experiments were conducted with reference to the passing of the disease (1) from leaf to leaf, and (2) from leaf to stem. The first series (leaf to leaf) was entirely successful in producing infection. The second series though regarded as convincing was not so decisive as could have been wished; the growth of the alga on the artificially infected shoots being poor and not altogether characteristic. Attempts to infect either leaves or shoots from infected stems were without result.

With regard to infection it is remarked that during the first year's growth the young shoots possess a rough irregular surface, but this during the second year is lost. Early stages of the disease are found in the crevices of the young bark and the authors are of opinion that the rough surface of the first year's growth is intimately connected with the infection of the shoots. The red patches which appear after the rains in April or May represent the fruiting stage of the infection of the rough surface of the previous year. Strong healthy shoots resist the disease by the formation of vigorous layers of bark, the alga being thus

thrown off. On weak poorly-developed shoots, on the contrary, the alga readily succeeds in getting a foothold and forcing its way through the bark reaches the cortical tissues. In bad cases the parasite may completely encircle the shoots and that for a length of several inches.

The practical conclusions to be drawn from the investigations are as follows. Cutting out infected shoots in May, and spraying at the same time of year proved useless, as also firing the bushes and collar-pruning. The most hopeful line of treatment is to promote healthy vigorous growth through good cultivation by attention to soil and drainage, at the same time removing weak and twiggy shoots. Overplucking should be strenuously guarded against, nothing causing lack of luxuriance more frequently than this. The destruction of infected leaves beyond those removed in pruning is not advocated, the alga being found too abundantly both on tea and other trees to be in this way materially reduced.

In the disease dealt with above *Cephaleuros* is a parasite on the tea plant; algae that are endophytic on the higher plants are not uncommon, but those that appear to be positively parasitic are extremely rare. The following cases may be referred to. Three other species of *Cephaleuros* are known to be injurious to foliage. *C. parasiticus* on *Calathea metallica*, *C. minimus* on *Zizyphus jubata*, and *C. Coffeae* on *Coffea liberica*. Amongst the *Protococcoideae*, *Chlorochytrium* and *Phyllobium* have been regarded as parasites, but the researches of Klebs have shown that the injury occasioned to the host-plant is practically nil. A closely related genus, *Rhodochytrium* presents, however, a decided advance in the direction of parasitism. *R. Spilanthidis*, found in the leaves of the Composite *Spilanthes* in Chili and Ecuador, is remarkable in not possessing chlorophyll. The spores of the alga germinate on the leaves of the host, the germ tube forces its way between the epidermal calls, enters the internal tissues, and sends out branches in the neighbourhood of the vascular bundles. Later a spherical body is developed, through the enlargement of the original germ-tube, in which the spores are formed. Another case is that of *Phytophysa Treubii* which has been described as forming gall-like swellings on the leaves and shoots of *Pilea* in Java. Here again the alga appears to be parasitic, and the tissue involved in the formation of the gall is not only that of the cortex but also that of the vascular system. Finally there may be mentioned the remarkable *Phyllosiphon Arisari*. This alga, parasitic in the leaves of *Arisarum vulgare*, is a member of the *Siphoneae* producing a richly branched system of tubes, without the formation of cross-walls. Sections through the infected areas of the leaf show dichotomously branched filaments which grow vigorously in the intercellular spaces, and form fruiting-bodies. The alga is regarded as a parasite, in that the filaments, although not piercing the cell-walls of the host, cause the death of those cells with which they come in contact, and in this way produce the large yellow blotches characteristic of the disease.

A. D. C.

New Zealand Fungi.—The second part of Massee's Fungus Flora of New Zealand was published in the Transactions of the New Zealand Institute, vol. xxxix. 1906 (issued June, 1907), bringing to a conclusion the consideration of the *Hymenomycetes*. The groups dealt with are the *Polyporeae*, *Hydneae*, *Thelephoreae*, *Clavarieae*, and *Tremellineae*.

The *Polyporus* group is well represented, species of *Polyporus* and *Polystictus* being as usual most abundant. *Boletus*, on the other hand, is at present unknown from New Zealand, a somewhat surprising fact, though probably to be explained by the difficulty that exists in drying specimens. Amongst tree parasites are to be found *Fomes igniarius*, and *F. salicinus*. A remarkable note is added in connection with edible *Hirneola polytrichi*. On the authority of Mr. T. Kirk this fungus "is collected and sent to China, where it is highly prized for food and medicine. In 1877, 220 tons, valued at £11,318, were collected in New Zealand and exported."

A. D. C.

The Flora of New Zealand.—The Educational Department of the Government of New Zealand has made arrangements for the publication of a series of 250 quarto, uncoloured illustrations of the native plants of that country. Mr. T. F. Cheeseman, Curator of the Museum at Auckland and author of the excellent Manual of the New Zealand Flora, which appeared in 1906, has been appointed Editor. The plates will be prepared in this country under the supervision of Mr. W. Botting Hemsley, Miss M. Smith is undertaking the drawings and Mr. J. N. Fitch their reproduction on stone.

Natal Botanic Gardens.—We are informed that the Natal Government have found themselves obliged to reduce the expenditure upon the Natal Botanic Gardens and the Herbarium. The grant to the Herbarium has been taken away entirely, whilst the grant to the Gardens has been reduced from £350 to £150. This action has necessitated the discharge of two of the assistants and a considerable reduction in the salaries of the Director and his Curators. It is difficult to see how the important work of the department can be carried on effectively under these straitened circumstances.

Solomon Islands Indigo (*Desmodium brachypodum*, A. Gray).—A collection of dried plants made in Ysabel Island, presented to Kew in 1893 by Archdeacon Comins, included a "dye-plant used by natives for staining their tappa cloth." It was identified with *Desmodium brachypodum*, A. Gray, a species, previously only known to inhabit Australia, where it has a wide range in the coastal region of New South Wales and Queensland. Further specimens were received in a collection made by the Officers of

H.M.S 'Penguin' in 1894–5; but these are not localized. Recently Mr. C. M. Woodford, Government Resident, British Solomon Islands, sent specimens accompanied by the following note:—"I now send some dried specimens and some seeds of a shrub from Ysabel Island for identication. It is the source of the native indigo dye, and so far as I know is peculiar to Ysabel. It is used for colouring the native bark cloth. The leaves are sprinkled with salt water and slightly wilted in the sun. They are then chewed by the women and the result is a dull blue stain in the mouth which has a very unpleasant appearance. To stain the cloth the women spit or smear the saliva upon it, altogether a very primitive and objectionable process."

So far as we are aware this plant has not been found elsewhere, except in Australia, though it may be expected to occur in New Guinea. It is not put to any use in Australia.

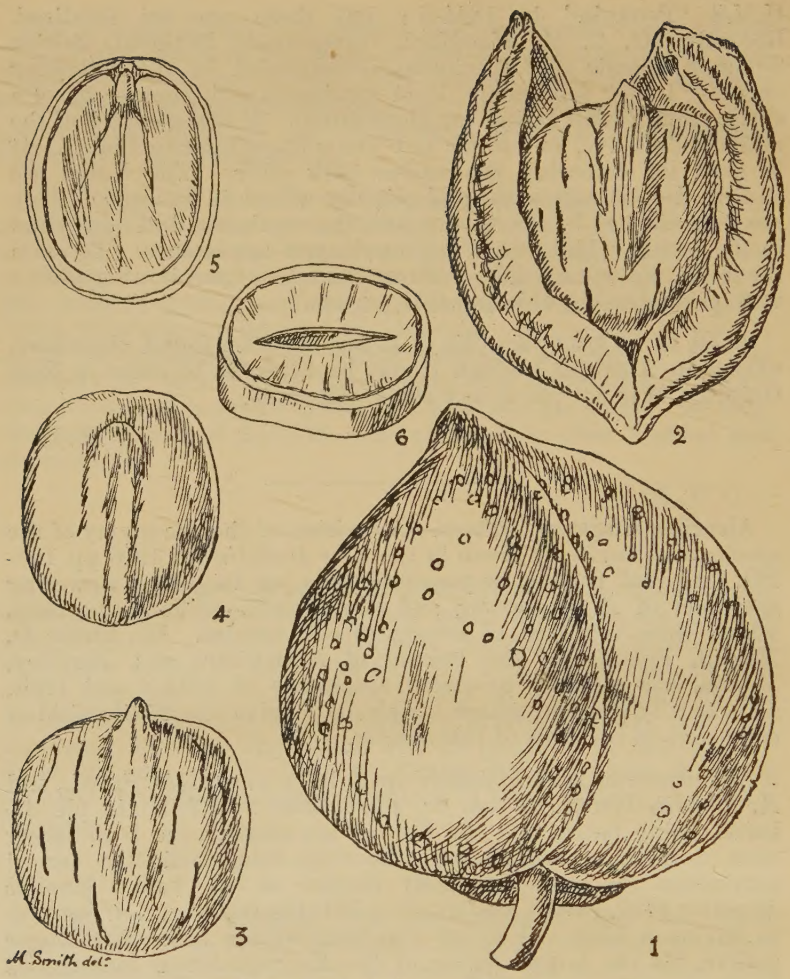
W. B. H.

Aleurites trisperma, *Blanco.*—A revision of the synonymy of the species of *Aleurites* is given in the *Kew Bulletin* for 1906, pp. 119–121. At that time Kew possessed only an imperfect flowering specimen of *A. trisperma*, and some seeds, without the testa, which were supposed to belong to this species. Mr. Elmer D. Merrill, Botanist of the Bureau of Agriculture and Forestry, Manila, has recently presented specimens of foliage and fruit, collected by himself, which enable us to give the distinguishing characters of the fruit of this species.

A. trisperma, Blanco, differs from both *A. cordata*, Steud., and *A. Fordii*, Hemsl. (*Hook. Ic. Pl.*, t. 2801 and 2802), in all the leaves being entire, and the flowers are smaller, the fruit larger with a thicker pericarp, and the very thin, distinctly nerved cotyledons are more decidedly cordate at the base. Mueller describes (*DC. Prodr.*, vol. xv., 2, p. 724) the leaves of *A. trisperma* as having a blade 10 to 12 cm. long with a somewhat longer petiole, but the largest leaves of the Kew specimens measure 25 by 20 cm. with a petiole 18 cm. long.

The synonymy of this species requires some explanation. Blanco (*Flora de Filipinas*, ed. 1, 1837, p. 755) described it under the name here adopted. In the second edition of the same work (1845) the description is repeated, p. 519, under the name *A. saponaria*, without any reference to the first name, and it is the same in the third, folio, edition, 1879, vol. iii. p. 19. The flowers are not figured in the plate 296 of the same work; but in the "Novissima Appendix" 1880, p. 191, *A. saponaria* is reduced to *A. trisperma*. The native names cited by Blanco are: Balocanad, Baguilumban, Calumban, and Balucanag. Mr. Merrill informs us that he has not met with this tree in an undoubtedly wild state in the Philippines. The oil, which is regarded as poisonous, is perhaps superior to Chinese Wood-oil (*K.B.*, 1906, p. 117) in its drying properties.

W. B. H.



Aleurites trisperma, Blanco.

Fig. 1, entire fruit, copied from Blanco (*Fl. Filip.* ed. 3, t. 296); 2, a carpel with seed in position; 3, a seed; 4, the same from which the testa has been removed; 5, longitudinal section of a seed showing the axile embryo; 6, a cross section of the same, from material supplied by Mr. Merrill. *All natural size.*

Spangle-galls eaten by birds.—In October of last year a small packet of "seeds" was received from Mr. F. Monteith Ogilvy, Ledaig, Argyllshire, N.B., together with a letter in which it was stated that the contents of the packet had been taken from the crop of a Grey-hen (the female black grouse), shot on October 17th. The crop of the bird was found to be full of these "seeds" and an immense number of small black beetles; a few days later the crop of a Black-cock was found with similar contents. The supposed seeds, which were yellowish-green and smooth, proved to be the common spangle-gall of the oak leaf (*Neuroterus lenticularis*),

the characteristic hairs having been rubbed off. Again in December the contents of the crop of a Pigeon (a bird of the year), shot close to Pembroke, were received at Kew through the Board of Agriculture and Fisheries, and in this case also the crop contained a large quantity of the common spangle-gall.

Hymenanthera novae-zelandiae, *Hemsl.*—The Norfolk Island *Hymenanthera latifolia*, Endl., was founded (*Prodr. Fl. Ins. Norf.* 1833, p. 70) on specimens collected by Ferdinand Bauer. In 1863 Mr. Henry H. Travers visited the Chatham Islands and made a collection of dried plants, published by Baron Mueller in 1864 under the title of *The Vegetation of the Chatham Islands*. Among these plants was a species of *Hymenanthera*, which Mueller named *H. latifolia* var. *chathamica*, remarking that "the specimens brought by Mr. Travers are fruit-bearing and correspond fully to Endlicher's description and Bauer's illustration (Endlicher, *Iconographia Genera Plantarum*, 1838, t. 108), with the exception of the margin of the leaf which is toothed by short regular notches." A portion of Travers's material was sent to Kew and unfortunately the name was erroneously transcribed *H. latifolia* var. *tasmanica*. In 1868 the late Mr. Thomas Kirk transmitted to Kew specimens of a *Hymenanthera* collected in Flat Island, one of the numerous islands east of Auckland, for the purpose of having it compared. From the manuscript records of that date it appears that he was furnished with the name *H. latifolia* var. *tasmanica* for the Flat Island plant, which means that it was identified with the Chatham Islands specimen bearing the erroneous name. Not finding any publication of this name, Kirk accepted it and described his plant (*Trans. N. Zeal. Inst.* 1871, vol. iii., p. 163) without any remark respecting its inappropriateness. As to affinities, he says : "var. *chathamica* appears to differ from our plant only in the leaves being much narrower at the base and more deeply serrated, and in the larger fruit."

The point of importance here is that whoever made the comparison at Kew was of opinion that the Chatham and Flat Island specimens were specifically the same, and the differences are so slight that we should regard them as individual rather than varietal. However, both Kirk (*The Student's Flora of New Zealand*, 1899, p. 45) and Cheeseman (*Manual of the New Zealand Flora*, 1906, p. 50) deal with them as independent species, and both agree in stating that there is little to separate them.

Both authors also agree in casting some doubt on the correctness of the identification of the New Zealand plant with *H. latifolia*, Endl., from Norfolk Island, Cheeseman observing that "it must not be considered as proved until specimens from both localities have been compared."

In connection with the Illustrations of New Zealand Plants announced, p. 92, such a comparison has been made. Kew possesses ample material of the Norfolk Island plant, including a specimen collected by Bauer, on whose specimens and drawings Endlicher founded his species.

There is also a specimen of *H. latifolia* in the Herbarium from a plant cultivated at Kew before 1864. It may be mentioned,

parenthetically, that most likely neither Kirk nor Cheeseman had access to Endlicher's *Iconographia* cited above, as neither refers to it. But with complete specimens and drawings of the Norfolk Island and New Zealand plants before me, I have no hesitation in viewing them as distinct species. *H. latifolia*, Endl., has relatively slender branches; thin entire leaves, much more finely reticulated than Bauer's drawing represents them; smaller flowers, and the staminal appendages are only fringed at the tips instead of minutely toothed all round the margin.

Further investigation brought to light the fact that Allan Cunningham's *Scaevola novae-zelandiae*, reduced to *Hymenanthera crassifolia*, Hook. f. (*Fl. Nov. Zel.* 1852, vol. i., p. 17), is the same plant. Cunningham, therefore, was the discoverer, and he collected it at Mataun on the sea coast opposite the Cavallos Isles, in 1834. The name is now usually written Cavalli, and these islands are situated to the north-west of the Bay of Islands. Mataun does not occur in the gazeteers consulted.

Cunningham, it may be added, had only imperfect specimens, and although he describes the fruit, none is preserved with the type specimens at Kew.

Accepting Cunningham's name for this interesting plant, the synonymy would be as follows:—

Hymenanthera novae-zelandiae, *Hemsl.*

Scaevola ? novae-zelandiae, A. Cunn. in *Ann. Nat. Hist.* 1839, vol. ii., p. 52.

Hymenanthera crassifolia, Hook. f., *Fl. Nov. Zel.* 1852, vol. i., p. 17, quoad specimen Cunninghamianum.

Hymenanthera latifolia var. chathamica, F. Muell., *Vegetation of the Chatham Islands*, 1864, p. 9.

Hymenanthera latifolia var. tasmanica, Kirk in *Trans. N. Zeal. Inst.* 1871, vol. iii., p. 163.

Hymenanthera chathamica, Kirk in *Trans. N. Zeal. Inst.* 1896, vol. xxviii., p. 514; *Student's Flora of New Zealand*, 1899, p. 45.

Hymenanthera latifolia, Kirk, *Student's Flora*, p. 45; Cheeseman, *Manual of the New Zealand Flora*, 1906, p. 50, non Endlicher.

The specimens of *Hymenanthera* collected in Lord Howe Island have hitherto been referred to *H. latifolia*, Endl., but they belong to *H. novae-zelandiae*, differing from the New Zealand specimens in having apparently thinner leaves, as seen in the dried condition, at least. The flowers are exactly the same.

In connection with this investigation it became necessary to look at the very closely allied genus *Melicytus*, and this led to the discovery that *Hymenanthera oblongifolia*, A. Cunn. (*Hook. Lond. Journ. Bot.* 1842, vol. i., p. 124), is the same as Norfolk Island specimens collected by Milne, Backhouse, and others, and referred to *Melicytus ramiflorus*, Forst., though whether they are really the same species is doubtful. *H. oblongifolia*, A. Cunn., is referred, in the *Index Kewensis*, to the very different *H. dentata*, R. Br., but we have not discovered on what authority, the name not being taken up in Bentham's *Flora Australiensis*.

W. B. H.